

HIDDEN HARVESTS

Community Based
Biodiversity Conservation

HIDDEN HARVESTS



GREEN FOUNDATION

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**Community Based
Biodiversity Conservation**



GREEN FOUNDATION

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For
18/12/02

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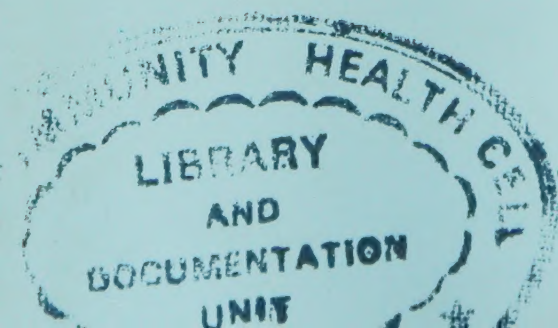
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Foreword

Sometimes I think we have been given a reprieve by Mother Nature. Or we would not have made any progress in attempting to conserve genetic resources which are a part of our heritage.

Green Foundation, with which I have the privilege of being involved, has been in the forefront in motivating small farmers to sustain themselves against the global juggernaut. Loss of genetic resources whether agriculture, livestock or natural resources could be devastating to this country, nay, to the entire Third World.

Green Foundation has gone beyond the customary in situ and ex situ conservation and explored and unearthed a path that once existed - on farm conservation. This then forms the basis of Dr Vanaja Ramprasad's book "HIDDEN HARVESTS - Community Based Biodiversity Conservation." The book is a factual account of the web of life and Green Foundation's record of the conservation of biodiversity and its multiple functions.

According to a recent World Watch Institute report, the global biological collapse has already begun. The report reveals that three-fourths of the world's bird species are declining in population or are facing extinction. It is not only wild biodiversity that is being lost. In the past 15 years, 1,500 local varieties of Indonesian rice have disappeared. Almost three-fourths of Indonesia's rice grown today descends from a single plant.

The erosion of diversity has been particularly severe in the Indian agricultural ecosystem. Crop varieties have disappeared. Cultivation during the Green Revolution phase shifted from hundreds and thousands of crops to wheat and rice derived from a narrow genetic base.



For instance, over the last half century, India has probably grown over 30,000 different indigenous varieties or landraces of rice. This situation has, in the last 20 years, changed drastically and it is predicted that in another 20 years, rice diversity will be reduced to 50 varieties, with the top 10 accounting for over three-quarters of the sub-continent's rice acreage.

The Green Revolution in agriculture, the White Revolution in dairy and the Blue Revolution in fisheries are "revolutions" based on the deliberate replacements of biological diversity, with biological uniformity and monoculture.

Biological diversity is not a luxury. Like all organisms, we humans too are ultimately dependent on others for our well being. Unfortunately, we continue to give a higher priority to short-term economic concerns than to the need to maintain biodiversity. Only if these priorities are righted can the squandering of our biological inheritance be avoided. Dr Vanaja Ramprasad in the vein of Thoreau's 'quiet desperation' tells us that if we do not wake up, our world will be a bleakly apocalyptic landscape with no trace of our spiritual, cultural and biological diversity.

Our colonial past seems to haunt and woo us like some latter-day Mephistophelean monster and we have succumbed to its lure and have welcomed the 'neocolonialism of globalisation'. This book not only helps us remember and recreate our past but also warns of the Judgement Day that is in store for us in the form of 'terminator' technologies that threaten the livelihood of farmers across the world. Green Foundation, which has sponsored this book, stresses that community knowledge is a treasure and to understand the level of biodiversity of an area, it makes sense to start with community studies. Thus, this

will serve as a bridge between peoples' knowledge and modern science. Green Foundation's network of farmers is saving seeds for the future through community seed banks which also serve as a field gene bank, thus averting potential loss of genetic diversity.

The portentous concocted doctrines of global multinationals trying to convince us about the safety of genetically modified crops are yet another pipe dream. One of the great delusions of the super-rich multinationals is that wealth bestows wisdom. This notion is tantalizingly beguiling when multinationals begin by succumbing to the all-too-natural tendency that they are infallible. Dr Vanaja Ramprasad and Green Foundation have set the record straight. In the book she quotes Robert Frost, and I would like to add, "and in the clearing lay two paths. And I took the one less traveled." This is what Dr Vanaja Ramprasad and Green Foundation have dared to do.

Dr H Sudarshan





Preface

The genesis of this work in conserving genetic resources in agriculture goes back to the 1970s. It was the decade of the Green Revolution with hopes and promises of a better tomorrow. At the time that the nation was rejoicing over the Green Revolution, I had the ironic task of treating malnourished infants who were the victims of growing inequality and poverty. Women walked into the hospital trekking long distances to have their children treated with medicines for marasmus and kwashiorkor. The conditions which were a result of inadequate food and nutrition were interpreted as diseases. For me it was the beginning of a search to understand the nexus between growing food production and poverty. Obviously, there were deep maladies inherent in food production in the social milieu of poverty.

Three decades have passed by and much water has flowed under the bridge. India's population has grown and with it, the levels of poverty, malnutrition and hidden hunger. As we step into the 21st century, the countries of the South carry a huge debt burden. Developing countries have passively participated in the process of development in the last three to four decades. The development model is synonymous with the development trends set by the developed countries. Today, we are on the threshold of globalisation and liberalized trade governed by the World Trade Organisation. There is no denying that the impact and burden of liberalisation has taken its toll on the poor, driving them to further poverty.

It is widely believed that poverty is caused by economic underdevelopment and overpopulation and that the problem can be solved through economic development and population control. There is a naïve belief that by merely increasing investments, creating jobs, raising incomes and improving the general standard of living, poverty can be eliminated. In my search for an answer to the question “why poverty?” I have stumbled upon the understanding that poverty is not the result of lack of development, poor technology, or scarce resources, but a manifestation of the very process of economic development that is supposed to cure it. It is not uncommon to narrate the argument for development-induced scarcity by citing the case of the Green Revolution and the miracle seed implicated in the social construction of scarcity.

By changing the very links between food, technology, ecology and culture, the Green Revolution became more than just a matter of increasing food production. A serious spin-off of the introduction of new seeds was the accelerated loss of genetic diversity. Uniformity in crop cultivation was accompanied by intensive use of chemicals, especially pesticides. Similarly, the introduction of water intensive crops drained the ground water, thus resulting in the scarcity of natural resources. The chain of events starting with the miracle seeds, to the use of the high external inputs, to the exploitation of valuable natural resources represents the destruction of the productive base of subsistence.

With “globalization” taking over the local economy, the productive base of the rural economy has been further undermined. Trade liberalization has exacerbated the problems of the poor in many countries. As the answer to my search unraveled, a proactive initiative in the form of a grass roots program of sustainable agriculture to empower the small farmer emerged, starting with on farm conservation to participatory genetic enhancement. This is precisely what has set the ground for working intensively with marginalised farmers in backward regions.

As we look back on the last ten years, we can say, with confidence, that our efforts have been focused and successful in reviving the genetic resources so basic to the survival of

small farms. In the process we have tried to bring together the economic, ecological, cultural and gender aspects of conserving biodiversity, bearing in mind the fast emerging global changes and their political implications.

Green Foundation's work has been driven by a deep urge to sustain the small farms against the onslaught of global pressures. In the initial phase this work was taken up with Dr Vandana Shiva, an acknowledged intellectual who has led this movement in India and abroad. We owe USC Canada and Dr Melaku Worde, renowned geneticist who trained two of our senior members for the conceptual clarity in our work. The work we have done in the last decade was made possible by the enthusiasm of the many farmers who joined hands with us, and the young team, friends and advisors who stood by us. In particular I would like to thank Dr Vasavi who has been a source of inspiration in writing this book. Funding organizations like Find Your Feet UK, IDRC Canada, SDC Switzerland, ETC Netherlands, have helped us to sustain this work and we would like to thank the many sensitive individuals from these organisations who interacted with us. This publication has been possible only because of the generous grant made to us by the American Education Foundation and for this we are grateful to Dr David Erhenfeld of Rutgers University.

Our team has gone through cycles of hope and despair, sharing the anxieties faced by thousands of farmers due to changing weather patterns and success and failure of crops. As we face new challenges at the end of a decade we hold hands with a human chain of farmers. Together we pledge to take the movement forward and I am reminded of Robert Frost who said, *"The woods are lovely dark and deep, but I have promises to keep and miles to go before I sleep and miles to go before I sleep."*

Vanaja Ramprasad

The Green Foundation Team

Krishnaprasad G, Shankar Nayak, Mallikarjun, Paramesh Mahadev, Nagaraj, Manasi, Swadika, Sudarshan and the many farmers who have participated in the conservation program.



Securing the future

Introduction

“Perhaps the biggest single environmental catastrophe in human history is unfolding in the garden. The loss of genetic diversity in agriculture - silent, rapid, inexorable is leading us to a rendezvous with extinction to the doorstep of hunger on a scale we refuse to imagine.”¹

The world has gone through periods of transition from subsistence to settled agriculture. In early civilizations food was restricted to berries, shoots, leaves, roots and fruits that could be gathered. Communities living in areas bordering the forests continue to do so even now. An understanding of the pharmacopoeia was developed through constant interaction with nature. Together with this, the choice of food was made according to social perceptions and cultural norms but as humans entered the Neolithic age, food habits changed.

The earth's genetic pool has thinned at an alarming rate in the recent past. The diversity that once existed expressed itself in terms of the varieties of plant and animal life, especially in the tropical regions. The industrialization of agriculture has resulted in the heavy use of external inputs in the form of chemical fertilizers to increase productivity. The technology developed during World War II made it possible to produce nitrogen fertilizers to enhance food production after the war. This period also marked the dawn of an era of “rice politics” in Asia that hit productivity. Rice was targeted since three-fifths of the world's

¹ Fowler, Cary and Mooney, Pat: Shattering – Food, Politics and the Loss of Genetic Diversity. University of Arizona Press. (1990)

population relied on rice as their staple food. The focus was to increase the production of rice per acre while compromising on all other farmer-preferred criteria. This was achieved by introducing new varieties that responded to external inputs by replacing thousands of landraces.

The fear of hunger and famine, rightly identified as an impending disaster, has become the concern of two groups of people: 1. Vested interests who want to further technology and offer that as a solution to fight the problems arising out of social inequalities; 2. Those who fear the consequences of furthering these technologies that go against the laws of nature. Modern breeding methods in subsistence crops like rice and wheat are among the technological interventions that have helped to halve the time needed to produce a new variety. Even though the impact of new varieties on global genetic resources has been devastating, the promise of alleviating hunger and poverty has been made, and the focus has shifted to increasing food production using modern technologies.

The period of colonization ended after several centuries. The world is now divided into 'developed' and 'developing' nations. A process of 're-colonization' through cultural invasion, technological supremacy and economic dependency has taken over. In the mid 1970s the "Green Revolution" gave nation states the power to produce adequate food for their growing populations. Many western nations, realizing that control over food production was more powerful than nuclear weapons, initially engaged in creating low intensity conflict through the remote control of technology, and more recently, through trade and commerce. Various international treaties and legislation to govern international trade have been put in place to achieve this. Initially this was done through a General Agreement on Trade and Tariff (GATT). Now this is known as the World Trade Organisation.

The observations of researchers like Keith Griffin² who authored a major report on the Green Revolution for the UN, have revealed the contradictions behind the euphoria of surplus food production. Achieving higher yields is directly dependant

² Griffin, Keith: *The Green Revolution: an Economic Analysis*. Geneva: United Nations Research Institute for Social Development, Report No. 72.6. (1972)

on the quantum of inputs including fertilizers and irrigation and purchase of the miracle seeds that respond to these inputs. The Green Revolution was based on the use of unsustainable methodologies, which led to the chemicalization of agriculture. Weedicides and herbicides were required to combat weeds nurtured by chemical fertilizers. The killing of predators led to changes in the microenvironment in the fields leading to the emergence of new pests. This automatically led to the extensive use of pesticides. Two decades of subsidizing agriculture with chemicals has impoverished the farmer and degraded natural resources and the diversity of food without reaching the goal of feeding the hungry. The negative spin offs and limitations diminishing biodiversity and food security raise an important question: Who benefits at whose cost?

Chemical intensive agriculture has resulted in the loss of biodiversity. This diversity was the basis for the livelihood of the millions in the Third World. Is it possible to restore the diversity to the farmers? What major efforts did the scientific community make to save the genetic resources of the world? When they woke up to the fact that the loss in diversity of food crops was bringing advances in agriculture to the brink, they immediately set out to conserve millions of collections from all over the world under controlled conditions of temperature and humidity. They called these the ex situ collections and stored them in gene banks. Thus the gene banks were born. Totalling over a hundred these gene banks are spread across the world, located mainly in the developed countries and maintained by the international agricultural research centers of the CGIAR. Of the 127 base collections, 81 are in the countries of the north and 29 are in the CGIAR system. The remaining are in the national collections of southern countries. On the eve of its tenth anniversary celebrations, the International Board of Plant Genetic Resources reported an impressive list of achievements. More than a million seed accessions across 120 species from eighty countries had been collected. A remarkable and impressive account indeed.

But the ex situ conservation is not without its limitations.

To name a few:

- ❖ The very first step of collections is determined by seed collectors, who according to Fowler and Mooney, “suffer from a kind of botanic xenophobia that makes them tiptoe through the millets, stomp thru’ the `teff’ and utterly disregard the medicinal herbs on their way to collecting the much needed barley.” The point is that even though these plants might be endangered, only barley is collected since it has commercial value.
- ❖ Life in a gene bank is different for different seeds that are subjected to the risk of power failure and other mechanical problems. Regeneration of seed samples is not as simple as it may appear. As indicated, climate, germination rates and resistance to disease and pests found at the grow-out site may affect the seeds in the sample unevenly, thus altering the composition and ratios of different types of seed in the sample.
- ❖ While the gene banks are considered a storehouse of raw material for plant breeders, issues of ownership (that is to whom the large collections belong and to whom the gene bank is accountable) have been the subject of enormous controversy and debate.
- ❖ Even the Rio Earth summit of 1992 which brought the catastrophe of dwindling biodiversity to the attention of the world, emphasized the need for conservation, sustainable use and benefit sharing explicitly and excluded all ex situ gene bank collections from the scope of national sovereignty.
- ❖ It is a recognized fact that the biggest shortcoming of gene banks is that they remove seeds from the evolutionary process which they would otherwise undergo in their natural environment.
- ❖ In addition, the germ plasm that exists in gene banks belongs to the farming community which selected, improved and conserved them for centuries. The farmers who have contributed to the evolutionary process of the varieties in the gene banks have no way of participating in the process.

Today attempts are being made to bridge the gap between the institutional and community systems in conserving plant genetic diversity. In situ conservation has been initiated as complementary to the gene bank concept. Seed conservation at the farmer level is different from the ex situ conservation measures in that, despite the introduction of miracle seeds during the Green Revolution, farmers in large parts of India prefer to retain and barter seeds among themselves, outside the market paradigm. This indicates that their own production and exchange networks have a continued relevance and significance. On farm conservation has other implications such as nutritional, ecological, economic and political imperatives which farmers recognize.

It is now clear that in situ and ex situ conservation complement each other and are guided by the same values of genetic diversity. These include qualities like high yield, palatability, acceptable color, texture, taste of the cooked grain and ease of storing. There are other qualities like high nutritional value, adaptation to the soil and climate, resistance to drought and extreme weather conditions and resistance to diseases and pests which farmers have valued over the centuries.

In situ conservation

The Rio Convention on Biodiversity in 1992 created a worldwide concern about the real threat of extinction of global biodiversity. It was accepted that the future of food security depended not just on stored crop genes, but also on the people who used and maintained the diversity on a daily basis. After decades of neglect in official circles, the CBD, Agenda 21 and FAO's Global Plan of Action (1997) have tried to redress this imbalance by placing greater emphasis on in situ and farmer/community level management of genetic resources.³

During this period, concerned individuals and groups initiated an informal effort towards collecting and conserving agricultural diversity. Efforts to work with communities conserving threatened species and varieties were formalized with critical questions

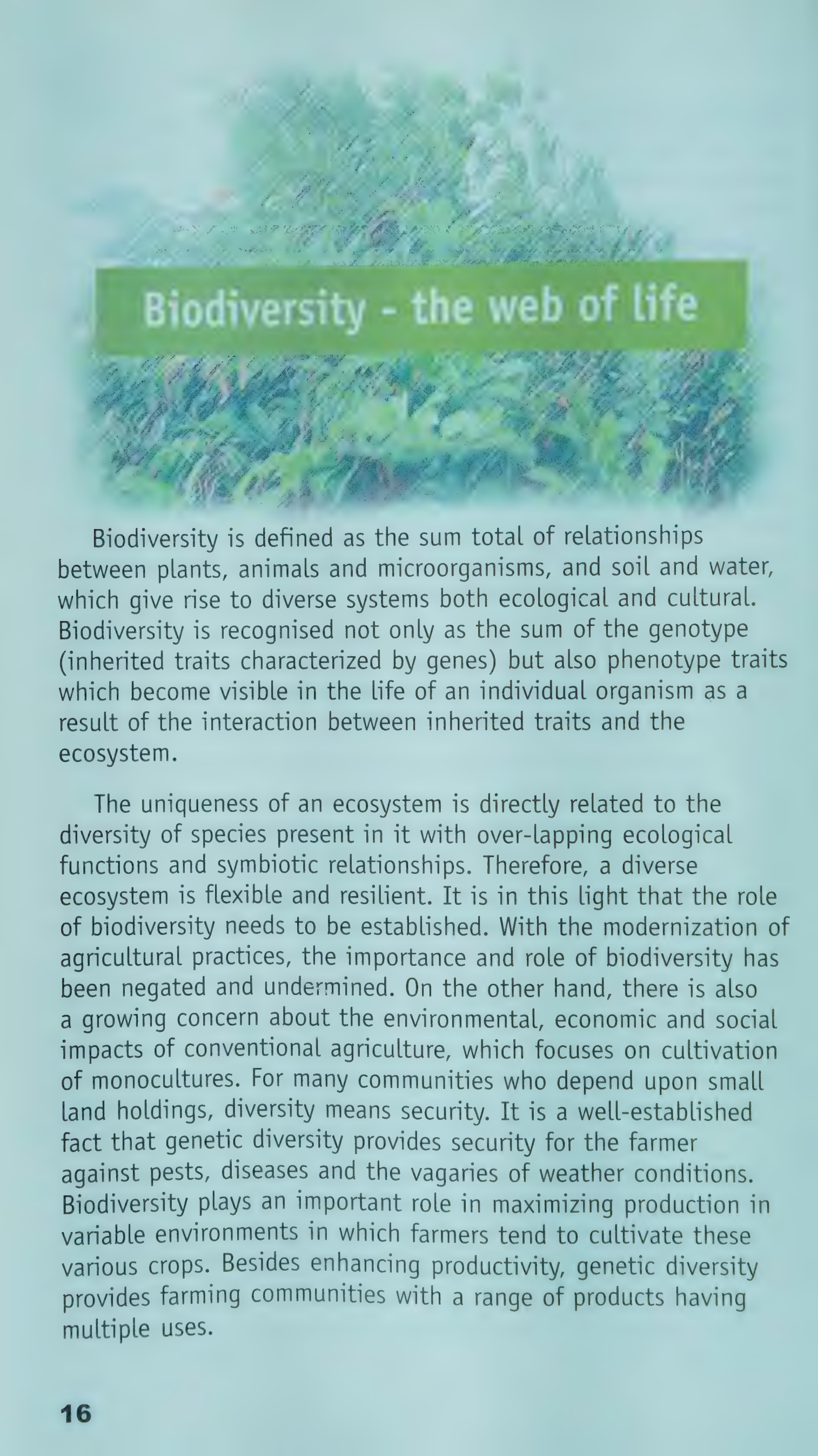
³ *RAFI: Human Nature: Agricultural Biodiversity and Farm Based Food Security. (1997)*

pertaining to the whereabouts of landraces, how they are collected and propagated, whether farmers would volunteer to undertake the responsibility of conserving them, and whether or not it would conflict with the farmers' interest to grow new varieties. It became clear that while many farmers had lost their indigenous varieties, there were some farmers in remote villages who, for reasons of their own, had kept the landraces. This initiated the collection of small quantities of these seeds. While these cultivars have not been bred as distinct, uniform varieties, they have, through natural and purposive selection become adapted to the conditions under which they were cultivated. The objective was to draw lessons from the fact that the "formal" world of research institutes, gene banks and plant breeders have sometimes worked against "informal" farmer-based systems, thus effectively limiting the capacity of both to operate and complement each other.

The FAO evolved some basic guidelines governing the implementation of in situ conservation.

- ❖ **To provide direct support in strengthening community innovation systems;**
- ❖ **To investigate and assess selected community innovation systems related to the conservation and use of PGR;**
- ❖ **To recommend ways in which the institutional system can better support and implement community innovation systems.**





Biodiversity - the web of life

Biodiversity is defined as the sum total of relationships between plants, animals and microorganisms, and soil and water, which give rise to diverse systems both ecological and cultural. Biodiversity is recognised not only as the sum of the genotype (inherited traits characterized by genes) but also phenotype traits which become visible in the life of an individual organism as a result of the interaction between inherited traits and the ecosystem.

The uniqueness of an ecosystem is directly related to the diversity of species present in it with over-lapping ecological functions and symbiotic relationships. Therefore, a diverse ecosystem is flexible and resilient. It is in this light that the role of biodiversity needs to be established. With the modernization of agricultural practices, the importance and role of biodiversity has been negated and undermined. On the other hand, there is also a growing concern about the environmental, economic and social impacts of conventional agriculture, which focuses on cultivation of monocultures. For many communities who depend upon small land holdings, diversity means security. It is a well-established fact that genetic diversity provides security for the farmer against pests, diseases and the vagaries of weather conditions. Biodiversity plays an important role in maximizing production in variable environments in which farmers tend to cultivate these various crops. Besides enhancing productivity, genetic diversity provides farming communities with a range of products having multiple uses.

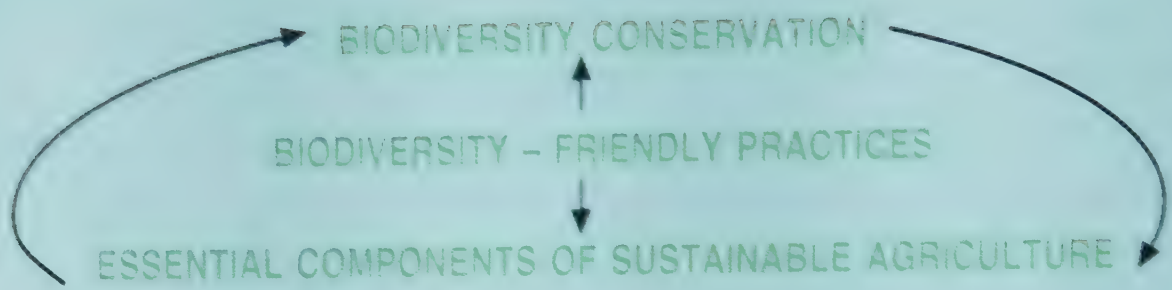


The role and significance of biodiversity in agricultural systems is well known. Natural methods of seed dispersal, control of weeds, insects and pathogens are known to effectively influence a biodiverse system. Natural biodiversity prevents soil erosion and provides the vegetative cover of a forestland or grassland while replenishing ground water. For farming communities, biodiversity performs various roles beyond production of food, fiber, fuel, fodder and income.

Based on thousands of years of knowledge and experience, agricultural communities have developed multiple strategies for preserving their farming systems. Understanding the wealth of information that has enhanced the role of biodiversity over centuries brings to light several biodiversity-friendly agricultural practices.



Adhatoda vasica



Biodiversity friendly practices are central to the idea of conservation of biodiversity, which in turn becomes an essential component of sustainable agriculture.

Biodiversity and Natural Pest Management (NPM)

The basic guiding principle of NPM is that there is no such thing as a pest. Diversity has an important role in building and maintaining an ecological balance. Some of the NPM practices that are based on observing and creating diversity are mixed or multi cropping techniques which include insect repelling plants, perennial trees and grasses; and preparation of bio-pesticides from different plant materials such as *Milea azadirachta*, *Vitex negundo*, *Calotropis gigantea*, *Pongamea glabra* and the like.

Nature has provided a pest control system, which needs to be preserved. Various kinds of birds, lady bird beetles, snakes, wasps, spiders, dragon flies, frogs, crabs, field lizards, chameleons, crickets and so on protect crops from pests by preying on unfriendly pests/eggs/larvae etc.

From the writings of sages like Varahamihra it is evident that, in the past, diversity of all living species was conserved and used very judiciously. The sage who lived during 500 AD writes on this concept in his treatise *Brihat Samhita*⁴. He says that before a piece of land is brought under a crop, sesame should be dropped down and incorporated into the soil before the seeds mature. Even now, based on reports from India and certain African countries, it is understood that incorporation of sesame reduces the biomass of unwanted weeds like *Cyprus rotundas* while the sesame leaves serve as a food trap crop for insects and pests.

⁴ Iyer, NC: Varahamihra's *Brihat Samhita*. (1965)



Some modern agricultural practices unsettle the ecological balance, especially due to overuse of toxic chemical sprays. These may kill anti-farmer pests but in the process, they destroy essential elements of biodiversity in the ecosystem, including beneficial insects.

In order to maintain the balance, farmers have resorted to various measures such as:

- ❖ ***Synchronized planting:*** Under this pattern, there is a fallow period between two rice seasons for soil preparation;
- ❖ ***Inter cropping:*** Planting a second crop between the main crop which reduces the spread of insects and diseases.
- ❖ ***Proper water management:*** Insects breed in humid lowlands and rice fields with standing water. The brown plant hoppers and green leafhoppers are more prevalent in flooded or standing water plots. Draining the field periodically destroys the eggs.
- ❖ ***Plant spacing:*** Since closer planting intensifies the severity of disease, spacing between plants is desirable. Spacing allows for solar radiation that restrains diseases. It also helps diverse natural enemies to breed in the fields, which in turn control pest/disease problems.



Calotropis gigantea

Some examples of mixed cropping, like maize with peanuts, have shown that infestation by maize stalk borer can be reduced. Similarly, tomatoes planted between cabbages reduce the potential for damage by the diamond back moth.

Trap plants play a similar role. For example:

Crop	Trap plant	Pest/s reduced
Wheat	Mustard	Aphids, Leaf hoppers
Tomato	Lady finger, cabbage, marigold	Aphids, diamond back moths
Carrot	Tomato, onion,	Carrot flies
Cow pea	Sorghum	Leaf beetles
Cucumber	Corn,	Cucumber beetles
Chillies	Coriander	Flies
Corn	Potato, pumpkin, sunflower	Army worms

Various botanical pest control measures have been in practice all over the world. Applications are comprised of a diverse selection of plants that have pest control properties. In this list, one can find plants like neem, tobacco, garlic, custard apple, chillies, turmeric, tulsi, *Vitex negundo*, *Aloe vera*, *Pongamia glabra*, eucalyptus and so on.

Biodiversity as green manure in sustainable farming systems


Another major sphere in which farm biodiversity contributes to enrich agriculture is the use of various types of green manure. Some of the perennials typically grown on bunds, avenues and waste land in India are *Cassia auriculata*, *Ipomea cornea*, *Thespesia populnea*, *Azardichta indica*, *Gliricidia sepium*, *Calotropis gigantea*, *Tephrosia candida*, *Vitex negundo* etc. Green manure crops are known to reduce the loss of nitrogen and other nutrients. They utilize the less available forms of phosphorus and zinc more efficiently than the main crop and in turn make them available to that crop.

The knowledge on the use of plant products has been dealt with well in *Viruksha Ayurveda*, the science of plants and trees.



Vetiveria zizanioides

- ❖ The deep roots of green manure plants break open the deeper and harder layers of soil, facilitating the movement of air and water in the soil.
- ❖ Green manure plants, especially the leguminous varieties, help fix nitrogen through the root nodules that contain nitrogen and contribute to the nitrogen requirement of the soil.
- ❖ Green manure plants unlock minerals from the vast reserves of the subsoil. Different plants accumulate various nutrients in their tissue cells. For instance, mustard accumulates sulfates. All these nutrients become available to the crops when the green manure plants are returned to the soil, either incorporated or directly used as mulch.
- ❖ The biomass produced by the green manure plants becomes nutrients for the soil organisms, thus protecting and enhancing the soil's biological activity.
- ❖ Green manure plants help to arrest the growth of weeds.
- ❖ Green manure plants are grown in between grain crops, protecting the soil against erosion through wind and water. It has been seen that even 30 per cent ground cover can significantly reduce soil loss.
- ❖ Green manure plants facilitate drainage in high rainfall areas.
- ❖ Green manure plants provide shade.
- ❖ The mulch from green manure plants reduces soil moisture evaporation.
- ❖ Green manure plants reduce soil compaction.
- ❖ Green manure plants provide a natural habitat for pollinating insects.



Farmers' aspirations - the basis for on farm conservation

"If winter comes can spring be far behind?" P B Shelley

Traditionally, farmers not only use a wide range of crop species in their complex agricultural systems of inter cropping and agro forestry, but also incorporate varieties of each crop in small cultivation plots. Several varieties of the same or different crops are mixed.

The reasons for traditional multi-cropping are:

- ❖ Provides insurance against failure of one crop due to failure of monsoon or other stress;
- ❖ Output increases because late varieties spread out after the harvest of one set of crops;
- ❖ Inter-cropping creates live mulches and increases biomass produced on the field;
- ❖ Different crops can be chosen according to soil depth and structure, water holding capacity, slope and drainage;
- ❖ Crop combinations that are suited for varied agro climatic conditions can be chosen.

In today's fast changing socio-political environment with a thrust towards a new economic order, talking about subsistence farming and conservation of indigenous varieties of crops may seem out of date. Yet, such agricultural systems/farms are the repositories of biodiversity and the genetic resources are invaluable for the farming community. The primary threats to biodiversity have come from attempts at modernisation, industrialization and mono-culturisation of agriculture, over use of chemicals and unchecked urbanization.

Factors contributing to the extinction of biodiversity

1. Growing urbanization leading to the neglect of agriculture
2. Increasing cash crops and land going under floriculture
3. Shifting cultivation to so called high value crops
4. Difficulties in the processing of millets
5. Spreading of hybrids extensively leading to the erosion of biodiversity
6. Government's policies undermining the underutilised crops

Local people cultivate for subsistence. A simple study of year-round food availability has revealed people's dependence on sources other than their own land, such as forests, ponds and lakes for at least part of the year. Thus the conservation of common property resources and the biodiversity therein, have played a major role in ensuring food security. The last two decades have witnessed several changes in the lives of the farming community.

Green Foundation's role in biodiversity conservation

Bio-resources and agriculture are two inseparable issues since bio-resources form the backbone of agriculture and people's food security. Following developments on the issue of plant genetic resource conservation both at the national and international level, Green Foundation (GF), working in the dry land regions of

southern India, took the initiative to involve farmers in the on farm conservation of the subsistence crops of the area. The focus on resource conservation was coupled with a genuine concern to protect the resource base of the poor. This became the basis of twin objectives of environmental conservation and enhancement of women's livelihood. The platform for building the various programs of GF was formed by the establishment of women's groups or sanghas in 40 villages. Currently GF works in approximately 100 villages in the remote districts of Tamil Nadu and Karnataka.

Green Foundation carefully analyzed the impact of the changing regional cropping patterns and the degradation of natural resources. Despite the fact that modernization of agriculture has penetrated into villages in the interior, there still exist villages set in undulating land, covered partially by dry, deciduous forests where communication is poor. Vestiges of traditional systems of agriculture remain in these areas.

With the advent of the Green Revolution and modernization of agriculture, changes in agricultural practices and cropping patterns have led to the erosion of genetic diversity. Staple food crops of the region where GF works, like finger millet and paddy were largely from high yielding varieties. The high yielding varieties were bred to exploit the yield potential of the parent lines thus compromising on the other essential qualities. In other words they were from a narrow genetic diversity. Therefore, the aim of Green Foundation was to increase diversity both in terms of species and varieties.

Green Foundation initiated a people's movement for in situ conservation beyond the limited scope of gene banks. Building farmer-based community seed supply systems and campaigning for farmers' rights to biodiversity have been the main focus. The concept is that on farm conservation and sustainable agriculture could converge with partnerships between farmers, scientists and consumers, thereby making biodiversity conservation the basis of sustainable agricultural practice and sustainable consumption patterns. In the course of the last decade several of the indigenous varieties have once again found their way into the farmers' fields. (See Box).

In situ farmers	794
Villages	109
Back yard gardens (13 villages)	60
Ragi varieties	39
Dryland rice varieties	29
Wetland rice varieties	25
Vegetable varieties	25
Millet	16
Demonstration farms for rice	2
Nurseries	6
Demonstration farms for ragi	3



1. Kamalamma in her field of little millet
2. Tall varieties of pearl millet
3. Kempamma with her harvest of deep water rice
4. Palaniamma in her finger millet field



1. Pachamma celebrating the multicropping
2. Rakeenamma with a harvest of mustard
3. Puteeramma - 'Beeja Matha' conserving 27 varieties of food crops
4. Sarojamma cultivating a special finger millet 'Pichakaddi'



Some of the highlights of Green Foundation's work are:

- ❖ Regeneration and distribution of the staple crops, several millets, pulses, oilseeds and vegetable seeds.
- ❖ On farm conservation, which includes interaction with individual farmers, community farms, community seed supply, training of farmers as key seed keepers and forming an association of farmers to take the movement forward. Sustainable agricultural practices form a major component of the training.
- ❖ Organising and conducting a 'seed mela' every year, which is held at different locations where people gather to celebrate their culture and agriculture.
- ❖ Identifying farmers to participate in plant breeding through varietal selection.
- ❖ Documenting indigenous knowledge and cultural practices on biodiversity and its use, paving the way for the revival and sustenance of the resource base of people.



Hombalamma - 'woman power' - an elected panchayat member
with her seed storage



The location and its people

South of Bangalore in India and close to this electronic and computer city, a cluster of villages nestle between the hillocks which culminate in the Mudumalai range of the Western Ghats. They are well shielded from the urban population and technological developments of the city and are populated mainly by farming communities and tribes. The traditional practices and perceptions of these rural people and how their daily lives are ordered are beyond the realm of scientific interpretation. Life for the people in the rural area revolves around the natural resources and an important and integral component of natural resources is the biodiversity of all forms of life from the tiniest organism to the wide variety of flora and fauna. With increasing urbanization, the burden placed on life supporting systems such as air, water, plant and animal life keeps increasing.

Like in any other place, the people here are also dependant on forests to meet a variety of their food needs. The forests have a variety of trees like neem (*Azadirachta indica*), 'hunise' (*tamarindus indica*) 'gandha' (*Santalum album*) 'honge' (*Pongamia glabra*), 'kari jali' (*Acacia arabica*) 'kaggali' (*Acacia catechu*) 'banni' (*Acacia ferruginea*) to name a few. The flora include a variety of tubers among which the large 'kadugenasu' (tuber found in the forest) is remarkable. The people have access to minor forest produce which is an additional source of income.

Conservation of plant genetic resources and biodiversity has been recognized as the most fundamental issue to sustainable farming and lasting food security⁵. It is evident in the context of India, where the last few decades of intensive modernisation of agriculture has narrowed the genetic base of cultivated crops.

Intensive agriculture has also contributed to the irrational use of natural resources resulting in extreme pressures on the resource-poor, small farmers, forcing them to compromise or abandon their sustainable farming systems.

Crops and cropping patterns of the area

In the Deccan region the minor millets play an especially important role in the daily diets of people. These include finger millet, kodo millet, foxtail millet, little millet, proso millet and barnyard millet. These millets are rich in minerals like iron and calcium. The straw from these millets is particularly highly valued as cattle feed and the return from the straw alone compensates for the expenses of cultivation.

Mixed cropping is an example of insurance against failure of crop being offset by the harvesting of other crops in subsistence agriculture. With the advent of 'dodda asalai male' (the big rain) in the month of July, the fields are ploughed and then raked, using an 'aluve'. The sowing starts after a 'pooja' is performed in the field. (The pooja is a ceremony with celebrations where offerings are made to nature). The fields are manured, following which ragi is sown. Mustard is mixed with ragi and this forms the basic fabric of the field. The farmer scatters these seeds in an arc with his hands.

'Jowar' (*Sorghum bicolor*) and other small millets, plus 'avare' (field bean), 'alsande' (cow pea) and castor are mixed together in different proportions and sown in rows. For this the farmer uses a 'saddike', a hollow cut bamboo pipe 4 cms in diameter with a wooden cone on top. Cattle draw the pipe in a straight line with the pipe either touching the ground at an angle or in an upright

⁵ Altieri et al : Agroecology. (1997)

GREEN FOUNDATION



TOWARDS CREATING COMMUNITY SEED DIVERSITY

STORAGE OF SEEDS

INPUTS FROM GREEN FOUNDATION ಗ್ರೀನ್ ಫೌಂಡೇಷನ್ ಒದಗಿಸುವ

WOMEN'S SANGHA

SHARE OF OUTPUT ಫಲವಿನ ಭಾಗ

COMMUNITY FARMING ಸಮುದಾಯ ಬೆಳೆ

position. 'Tuar' (pigeon pea) and 'jola' (sorghum), 'avare' with foxtail millet and proso millet and castor are mixed in small quantities usually forming alternate rows in the ragi field. One row of 'huchellu' (niger) and 'sanna alsande' (cow pea) in the borders enables easier harvesting of ragi. Niger planted around the field acts as a pest repellent.

Agricultural calendar

An agricultural calendar for farmers follows the movement of the stars and 27 such stars are identified by different names. According to the agricultural calendar constructed with the help of women farmers, the season starts with the Ashwini (star) rains in the month of May, when farmers begin preparing the land.

The people in Karnataka call agriculture 'aaramba' which literally means "that which has no end." With the 'Krithika' and 'Rohini' rains in June and July the sowing of different crops begins. It is during this time that the reserve of food is at its lowest for people and cattle. This period coincides with the 'Magge male' (the big rain) followed by the 'Ubbe' and 'Uthrai male'.

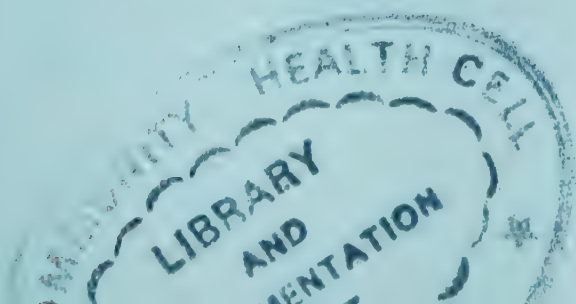
This is a time of low employment and receding stocks of food. However, the fields and neighbouring forests are full of diverse edible greens and other useful plants which could be termed "weeds" in the conventional sense, but are a source of food for the villagers. This is a classic example of food not only from cultivated grains but also from a diversity of uncultivated vegetation that is widely available. During February and March, when the direction of the winds is favorable, winnowing is performed. It coincides with the New Year and is the occasion for joy and gaiety.

In the ragi growing areas of South India the first flower to bloom is mustard. Coinciding with the appearance of the flower a festival called 'Gowri pooja' is celebrated which maintains the relationship of the plant with water, soil and other crops. The Goddess Gowri is identified as the goddess of water, being essential for the growth of the crop, and with the fertility of the flower so that a good grain is formed. As part of the ritual the flowers are brought home and worshipped. In parts of the sorghum growing regions of Karnataka young unmarried girls collect contributions from the public by singing songs praising the power of Goddess Gowri. The girls bring fresh soil from the village pond to symbolise fertility and make an idol out of it. After the ceremony the idol is immersed in water. The ceremony thus revives the connections between soil, water and biodiversity.

Women - custodians of biodiversity

Women play a major role in conserving diversity at the farm level. It is women who decide on the amount of seed that has to be stored, the variety and the different ways of storing them. The role of women in the selection of seeds begins when the crops come into flower. Because women are involved in weeding, harvesting crops and collecting grains, they watch plants grow through their whole life cycle and are best placed to select the seeds.

Puteeramma is a farmer, mother, grandmother, seed conservator and organic cultivator all rolled into one. She lives



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in a small village hidden in the valley between the hilly slopes bordering Karnataka and Tamil Nadu. Frail in body but strong in her convictions about her heritage and traditions, she holds on to her five acres of totally rainfed land. She wakes up to the sound of birds on her land which bears finger millet, dryland paddy, lentils, redgram, field beans, cow pea and sorghum.

Puteeramma is not an isolated example of a woman who has internalized the need for conserving biodiversity in food crops. Women in rural communities worldwide contribute to sustainability in food production. While the diverse tasks of women are extremely difficult to quantify there is no dispute about the role of women in securing food for the household. The role of women in subsistence agriculture is based on the multiple use of biomass for fodder, fertilizers, food and fuel. In addition to their responsibilities for the farm and the household, women are custodians of the food basket of the family.

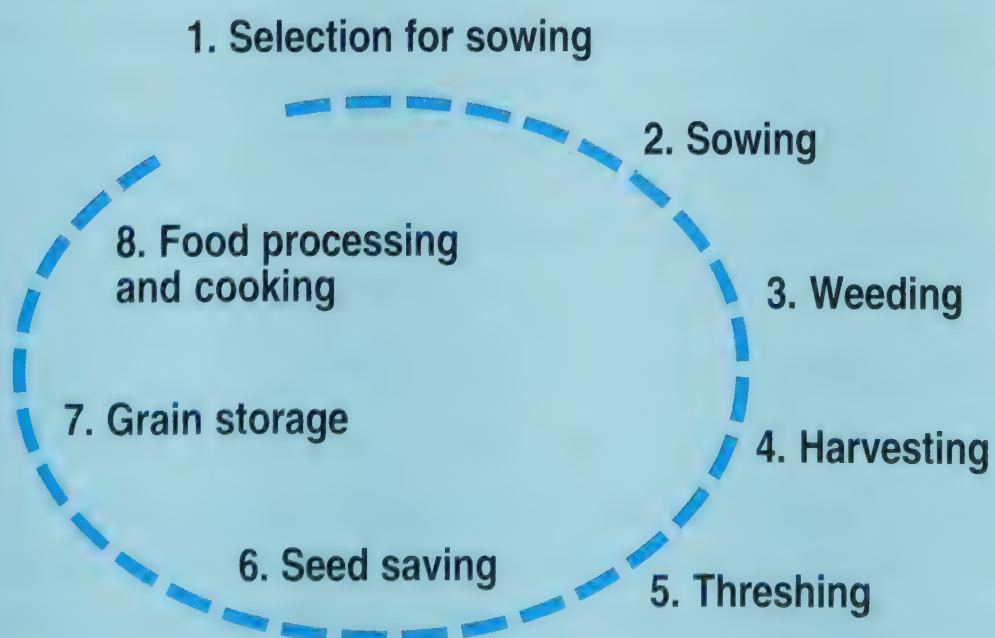
Puteeramma believes in returning to nature what she takes from it. Besides the diverse species of crops and animals that she conserves, Puteeramma also specialises in growing exclusive varieties of paddy and finger millet.

There are other features of self-sufficiency in food and storage systems that need a special mention. Studies have indicated that women in India are major food producers in terms of value, volume and quality. An interesting study of gender division of labour has shown that women do 37% of sowing, 59% of interculturing, 60% of harvesting of crops, 59% of threshing and 69% of the work related to the tending of animals. Men and women work together in a complementary way. The difficulty arises when decisions have to be taken on whether to grow for the market or for home consumption. The key role of rural women as food producers and providers is directly related to the diversity of local food crops and the surrounding available biodiversity. The local market has only cereals and pulses to offer during the months after the harvest. Subsistence farmers therefore depend upon the planting material saved by women from their previous harvests. Women's specialized knowledge of the use of crops extends to wild plants, including leaves, fruits, berries, nuts, seeds, edible roots and pulses.

For farmers like Puteeramma, biodiversity is manifested in cultivated food as well as wild plants. This is however threatened by modern agriculture, which is fast replacing local genetic material. Common property resources that are the reservoirs of biodiversity are uncared for or exploited. These threats especially affect the people that rely on them for their survival.

The traditional Indian system of people's rule through panchayats or local self-governance was dismantled during the British colonial rule. Panchayats were responsible for the care and maintenance of all common property resources. After independence the panchayats were restored but only for administrative purposes, while the responsibility for caring for common property resources continued to be vested with the government. Local knowledge, skills and social and cultural diversity in the use of natural resources are not acknowledged in the panchayati institutions. Women like Puteeramma are struggling to maintain their identity, culture and biodiversity under such a changed regime of governance.

LIFE CYCLE ANALYSIS OF FOOD PRODUCTION ROLE OF WOMEN



Women and sacred seeds

Identification of pods and fruits bearing good seeds commences with the collection of green vegetables and pulses, which are grown alongside ragi or jowar. While collecting the green beans women identify which plant will mature into seed of good quality on the basis of size, grain formation, freedom from pest and insect attack.

Those with large ear heads are consequently set aside to be reproduced as seeds. While selecting and storing seeds, women determine the quantity needed for two planting seasons. This is practiced as insurance against the risk of drought and the possibility of seed loss. In addition some of the grain is kept aside for the poor and as an offering to the gods and goddesses.

In the case of cereals, when the selected ear heads are brought to the threshing yard, women perform a ritual ceremony or 'pooja' to welcome the first cartload. On the concluding day of the threshing work, women worship the heaps of grain. Before transporting the grains home, a part of each heap is given to the poor. All those families who provide various services to the village are also gifted some grain.

Ritual and seed quality

Before the seeds of cereals are taken away for storage, women perform a ritual to invoke all the forces that are responsible for a good crop. Water is symbolized in the form of a winnowing pan; leaves of the 'lakkli' tree (*Vitex negundo*) symbolize pest protection. Cow dung and grass represent soil fertility.

This ritual locates biodiversity conservation in the complex web of life and maintains and rejuvenates plant productivity.

The ritual is an important aspect of seed preservation. Thus, the leaves used in the ceremony for pest control will be used for seed storage. The 'lakkli' leaf is used to preserve paddy because it acts as an insecticide. Wherever 'lakkli' is not found in abundance, neem is used instead. In a few cases large seeds are mixed with other small seeds to fill in air spaces for preservation. For example, *dolichus lab lab* or field beans are mixed with

mustard or ragi for preservation. 'Tur' is mixed with sand for preservation. In some instances, seeds are stored above the kitchen, so that the smoke from the stove keeps the pests away.

Seed quality is tested through a variety of ceremonial rituals. The stored seeds are tested for germination during a festival depending upon the importance of that festival in the concerned region. It could be 'Ugadi' (the local new year as per the Hindu calendar based on the lunar cycle) or the 'Kammanna' festival, or the feast of the village gods.

In the sorghum region in the northern part of Karnataka, immediately after the threshing operations, farmers celebrate a festival called 'Kammanna habba' during which people express their gratitude to the planets for cooperating in securing a good crop. During this ceremony women draw symbols representing various planets and worship them daily for three days. Before the conclusion of the ceremony, the women of each household make small heaps of the seeds they have collected that year. On each heap, they pour sanctified water. If the water carries off the seeds, they are considered to be of good quality. If they are not, women of that household have to look for an exchange or borrow seed from others.

On the last day of the festival, after conducting the quality test, a germination test is carried out. All the seeds previously screened for quality are placed in a coconut shell within a medium of good manure selected from the manure pit. These grains, including cereals, pulses, and oilseeds are placed in the shell for a test.

Normally nine seeds are placed in the shell and are hence referred to as 'Navdanya.' These seeds are worshipped, and on the seventh day when they have sprouted, they are examined. Seeds, which have not sprouted well, are replaced. Thus, due to repeated testing, the quality of seed in the individual farming household is maintained.

In the ragi growing area, the test for quality is not conducted immediately after the threshing ceremony, but the test for germination is performed during 'Ugadi.' On this day, as an offering to the household deity, the farmer and his wife place all

the seeds which have been selected for reproduction during the coming agricultural season on a wooden plank in the manure brought from their own farms. This manure is dried before it is used. After sowing the nine pulses, cereals and oilseeds, the seeds are worshipped. On the seventh day, the plank with the seeds is carried to the nearest water body, where the seeds are examined for sprouting. If the sprouts are not good or are too few in number, or the growth does not meet the expectation (about three inches in length), then the seeds of that particular variety will be rejected for sowing in the coming agricultural season. In that case, the farmer will look for replacements.

WOMEN’S ROLE IN FOOD PRODUCTION	
Production phase	Planting, tillering , weeding and harvesting
Post harvest phase	Storing and processing
Trading phase	Selling small produce (Local markets)
Daily meal phase	Gathering fuel and water for cooking
Nursing phase	Caring for the children

A few days prior to sowing, the seeds are taken out from storage for drying and cleaning. If, due to improper storage, pests have affected them they are weeded out and good seeds are picked. On the day of sowing, women place all the seeds meant for sowing in front of the household deity and worship them. On their way to the fields each woman carrying seeds visits the seven village goddesses (known as the seven sisters) and makes an offering before the commencement of sowing.

Women also worship the draft animals and the farming implements to be used during sowing. In the sorghum-growing region, it is only women who carry out the sowing whereas in the ragi growing region women hand the seeds to the men. The seeds offered to the village gods and goddesses are given, free of charge, to the poor.

None of these procedures is followed for the so-called high yielding varieties (HYV), the seeds of which are purchased in the market. While the farmer-reproduced varieties are considered sacred, the HYV varieties are considered impure. They are sent directly to the field and it is the men who are exclusively responsible for their sowing.





The path of rediscovery

The legacy of the Green Revolution

The last three decades of development in India, based on the Nehruvian model (with importance given to industrialization) witnessed, amongst many other things, the disappearance of the social institutions and culture of rural people. As a result, agriculture, the mainstay of the people, was transformed from a predominantly peasant based livelihood into a subsidiary activity. Agriculture is now mainly dependent on loans and credits and is being highly influenced by the agriculture extension departments to move towards a dependence on the market forces for all inputs, starting with the seed.

India has been identified as a country of megadiversity. Scientists like Dr Richaria have documented the rich diversity in food crops like rice, the main staple food of the region. The varieties of rice in India have, apart from their gastronomic qualities, unique medicinal value. The introduction of new seeds narrowed the diversity considerably. Similarly, the genetic diversity in other subsistence crops which are region specific were also narrowed during the post Green Revolution period. In the case of pearl millet, hybrid varieties and in crops like finger millet which is a self pollinated crop, high yielding varieties were introduced.

On farm conservation: breaking new ground

It is against this backdrop that a plant genetic resource conservation program, resulting in village based community

seed banks was conceived. Over the years the program has grown through stages of collection, multiplication, monitoring, evaluation and farmer participation in selection, rating and distribution. The challenge was to integrate the seed conservation efforts with the remnants of indigenous practices by reinvesting people's faith in their own systems.

Indigenous practices of agriculture depend largely upon good rainfall and ample organic manure. These facilitate a good harvest of grains. Mixed cropping favors cultivation of diversity which enhances the ecological and economic conditions.

Seed collection and multiplication

Minor millets including finger millet, kodo millet, foxtail millet and barnyard millet are grown over 7 million hectares in India producing 5 million tonnes of grain. The crops are very similar to the millets grown in Sub Saharan Africa. According to a recent report by the National Research Council in the first of a planned series of reports titled "Lost Crops of Africa"⁶ an expert panel examining the grains said that Africa has more indigenous varieties of cereal than any other continent.

The richness of the varieties of millets in the dry lands of southern India is similar. The minor millets as they are called include finger millet, pearl millet, kodo millet, foxtail millet, little millet, proso millet and barnyard millet. Finger millet alone accounts for 2.6 million hectares with a production of 3 million tonnes and is the staple food for millions of people in Karnataka, Tamil Nadu, Andhra Pradesh, Orissa, Maharashtra and Bihar.

The different millet varieties have been collected from similar ecosystems and identified by the distinctive names given by farmers. Finger millet varieties are known in Kannada as 'Jenugoodu', 'Karikaddi', 'Majjige', 'Sannakaddi.' Small quantities of seeds are multiplied to be later distributed to the farmers. Rainfed and wetland varieties of paddy are also a major component of the collections.

⁶ National Research Council : Lost Crops of Africa. (1996)



Inter species diversity
in finger millets



Intra species
diversity in millets



Diversity in sorghum and amaranth

It is very obvious from a participatory rural appraisal that the diversity in the area was richer three decades ago than it is now. (See Appendix 1). Farmers have correlated the arrival of high yielding varieties and the decrease in the intra species diversity of crops that are grown as intercrops. This area has proved to be a good case for rehabilitation of the lost diversity.

The seed conservation program is aimed at capacity building at the grassroots level, enabling the local communities to focus on low external input cultivation systems. From the very beginning it has been recognized that on farm conservation cannot be sustained through external subsidies, and that the seed production is based on organic cultivation.

Role of the conservation center

- ❖ **Collection and storage of seeds**
- ❖ **Seed regeneration and maintenance of viability**
- ❖ **On farm conservation**
- ❖ **Demonstration plots**
- ❖ **Multiplication and distribution of seeds**
- ❖ **A place that gives support to the biodiversity conservation through farmers' fairs, exhibitions, training and workshops**



Traditional seed storage in mud pots



Traditional seed storage - 'moode'



Traditional seed storage - 'kanaja'



Underground seed storage

The concept of a movement around seed conservation, though not familiar to the people has been welcomed by the older generation since knowledge of the indigenous cultivars already exists amongst them.

In selecting a site for on farm conservation, different criteria have been considered.

The on farm conservation site is an area:

- ❖ where dry land subsistence farming is practiced
- ❖ where the context of socio-economic and cultural diversity is relevant
- ❖ where landraces are under the threat of genetic erosion
- ❖ rich in farmers' knowledge and skills in seed selection and conservation
- ❖ which is accessible
- ❖ which has access to a market
- ❖ where intra species diversity still exists

On farm conservation sharply focuses on:

- ❖ **widening the status of biodiversity**
- ❖ **conserving landraces by value addition to local crop diversity**
- ❖ **strengthening the process of on farm conservation through participation**
- ❖ **enhancing the value of biodiversity and increasing productivity**

Value-addition has been brought about in two ways. The first involves improving the quality, disease resistance, yield, taste and other preferred traits through seed treatment for improved germination, and by building resistance against seed borne diseases. The other involves adding value to increase the demand for the material or improve the derived product.

‘Seed melas’ are the high point of the year-long activities that follow the agricultural seasons. The melas provide an opportunity for farmers to select the varieties, interact with other farmers with similar interests and exchange seeds. Thus, every year, the number of farmers who conserve the varieties of millet, upland rice and lowland rice increases. Between the year 1994 and 2001, the increase in the number of farmers who participated in the seed conservation and the villages to which the concept spread are indicated in Tables 1 and 2.

The focus on organizing the farmers around the issue of seeds is to improve the seed supply system and strengthen the farmers’ role as conservers and producers.

Farmers’ Association

An apex body of farmer representatives is in the making to take over the management of seed conservation, production and distribution. Communication and networking becomes a part of the farmers’ organizational ability.



'Seed Melas' - a platform for farmers' gatherings



Community farming with women

Women who have land but cannot cultivate it due to extreme poverty are involved in community farming with inputs to facilitate the seed bulking. The harvest of the multiplied grains is shared amongst the women who participate in the community farming with a share given to the foundation for further distribution.

Table 1

Years	1994	1995	1996	1997	1998	1999	2000	2001
No. of farmers	10	22	32	105	278	348	543	607

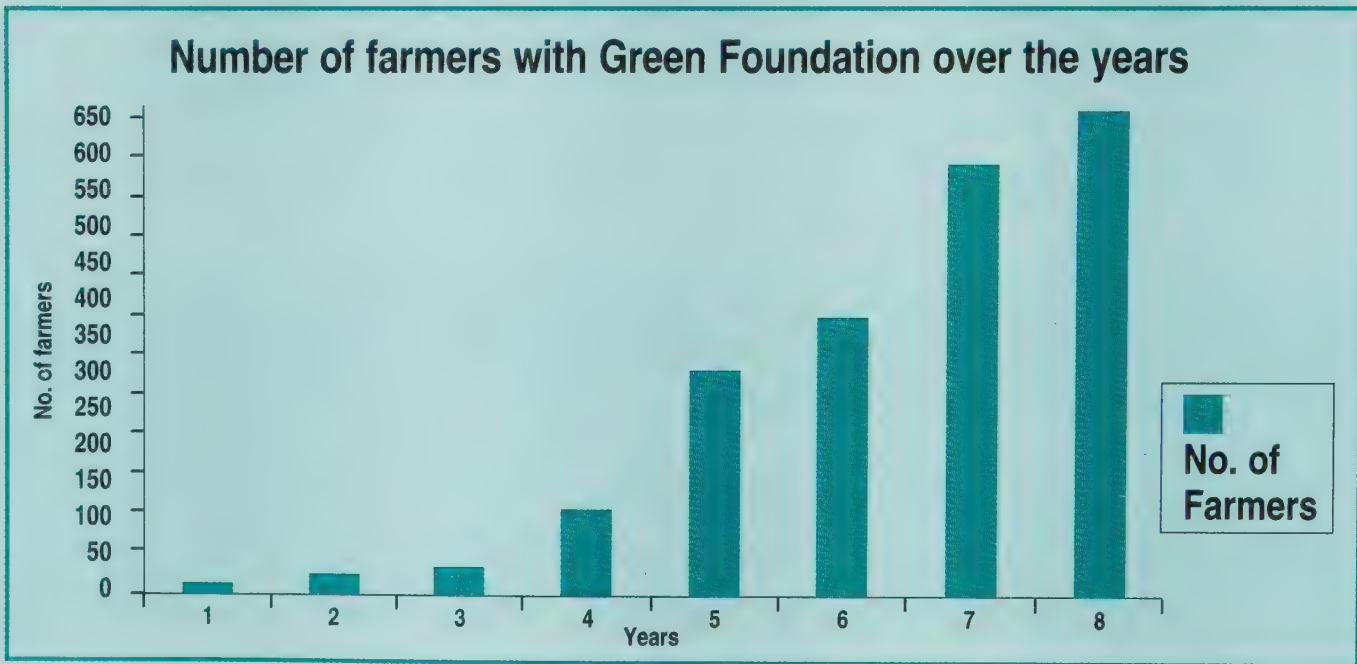
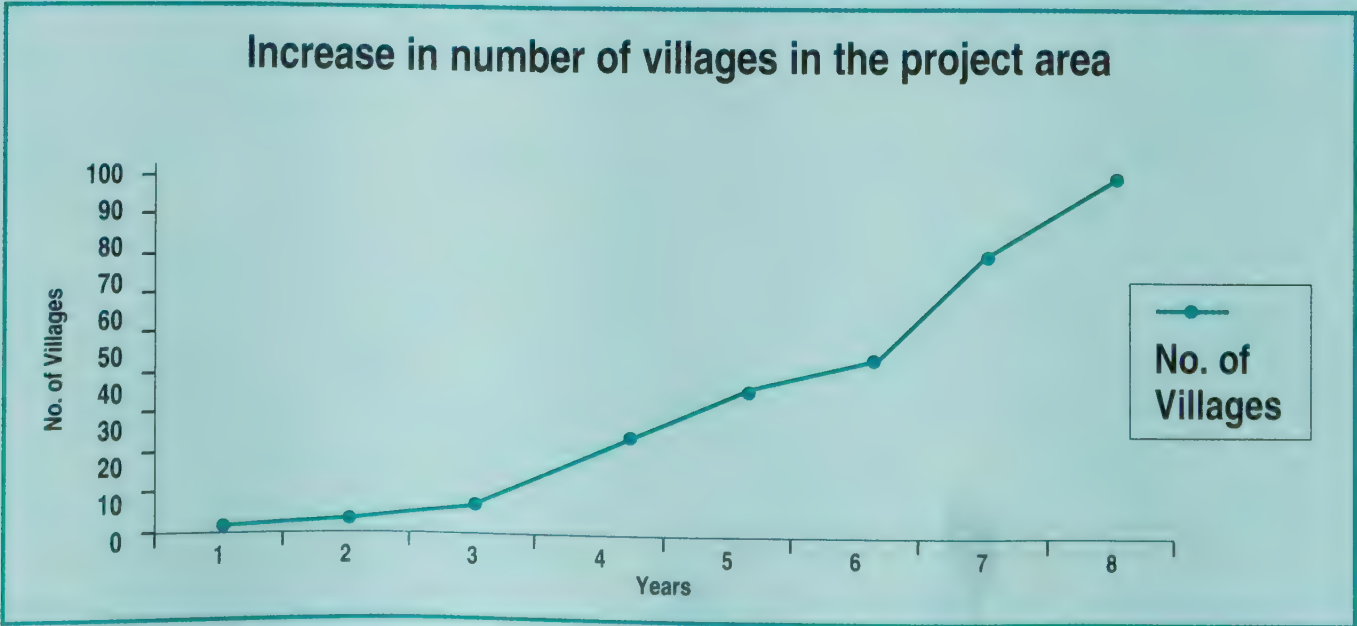


Table 2

Years	1994	1995	1996	1997	1998	1999	2000	2001
No. of villages	2	4	10	28	41	58	83	113



Crop improvement through participatory varietal selection

Farmers have been involved in the breeding of crops ever since agriculture began. The intervention of “experts” is only a recent trend. In the past, farmers played the role of plant breeder, by domesticating wild species, transporting seeds to new areas, adapting varieties to new ecological niches and selecting plants that had special value. In contrast to this, the modern approach to plant breeding has become centralized with a rapid increase in land under modern varieties, thus eliminating the farmers’ varieties. As a result, now it is a universal phenomenon to see monocultures of a few varieties being grown. As an important step towards seed conservation and creating a stable system of community seed supply, a participatory breeding program has been initiated to involve farmers in the varietal selection process.

The approach to varietal selection involves four phases:

- ❖ Identifying farmers’ needs for a variety
- ❖ Searching for suitable material for on farm trials
- ❖ On farm trials to test acceptability in farmers’ fields
- ❖ Wider dissemination of farmer-preferred varieties



‘Raskadam’ - rice variety under threat of extinction

R A G I

Village level Participatory Rural Appraisal: Criteria for choice of variety

RAGI

GENERAL REQUIREMENTS

- a) Must be of medium duration
- b) Medium to tall growing
- c) Withstand environmental variation
- 1. Drought tolerant
- 2. Pests and disease resistant
- 3. Non shattering during heavy rainfall (at harvest) and at lodging conditions
- d) Non-lodging type
- e) High tillering & multiple branching
- f) Uniform maturity
- g) Good response in marginal lands
- h) No on-plant germination if undue rainfall interferes with the harvest
- i) High yields with low inputs

FOR MARKETING

- a) High yields
- 1. Low husk type
- 2. Bigger sized ear head
- 3. Long and closed fingers
- 4. Bigger grain size
- 5. More layers of seed on each finger
- 6. Heavy ear heads
- 7. Test weight should be more

FOR FOOD

HUMAN

- a) Red color with sweetish taste
- b) Straw hard, palatable
- c) Small amount should give enough satisfaction

ANIMAL

- a) Straw yield should be more
- b) Straw thin, slender, long stem
- c) Straw must be sweet, as it is preferred by the cattle



Pearl millet

RICE**Village level Participatory Rural Appraisal: Criteria for choice of variety****RICE****GENERAL REQUIREMENTS**

- a) Medium to tall variety
- b) Preferably short to medium duration
- c) Non-lodging
- d) High tillering
- e) Resistant to pests & diseases
- f) Non-shattering
- g) Drought tolerant
- h) Erect leaves so as to accommodate more plants per unit area

FOR MARKETING

- a) Should have greater market demand
- b) Long and heavy panicles
- c) Good color and more grains
- d) Low input responsive

FOR FOOD**HUMAN**

- a) Medium to small grains
- b) Sweet and starchy

ANIMAL

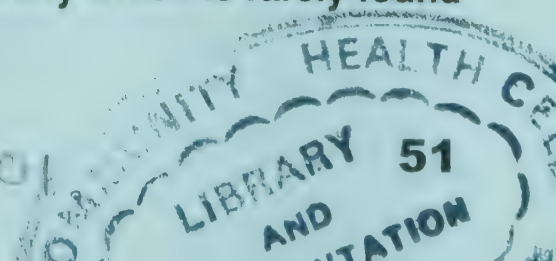
- a) Good straw yield
- b) Long & sweet culm



'Laxmi kajal' - a rice variety which is rarely found

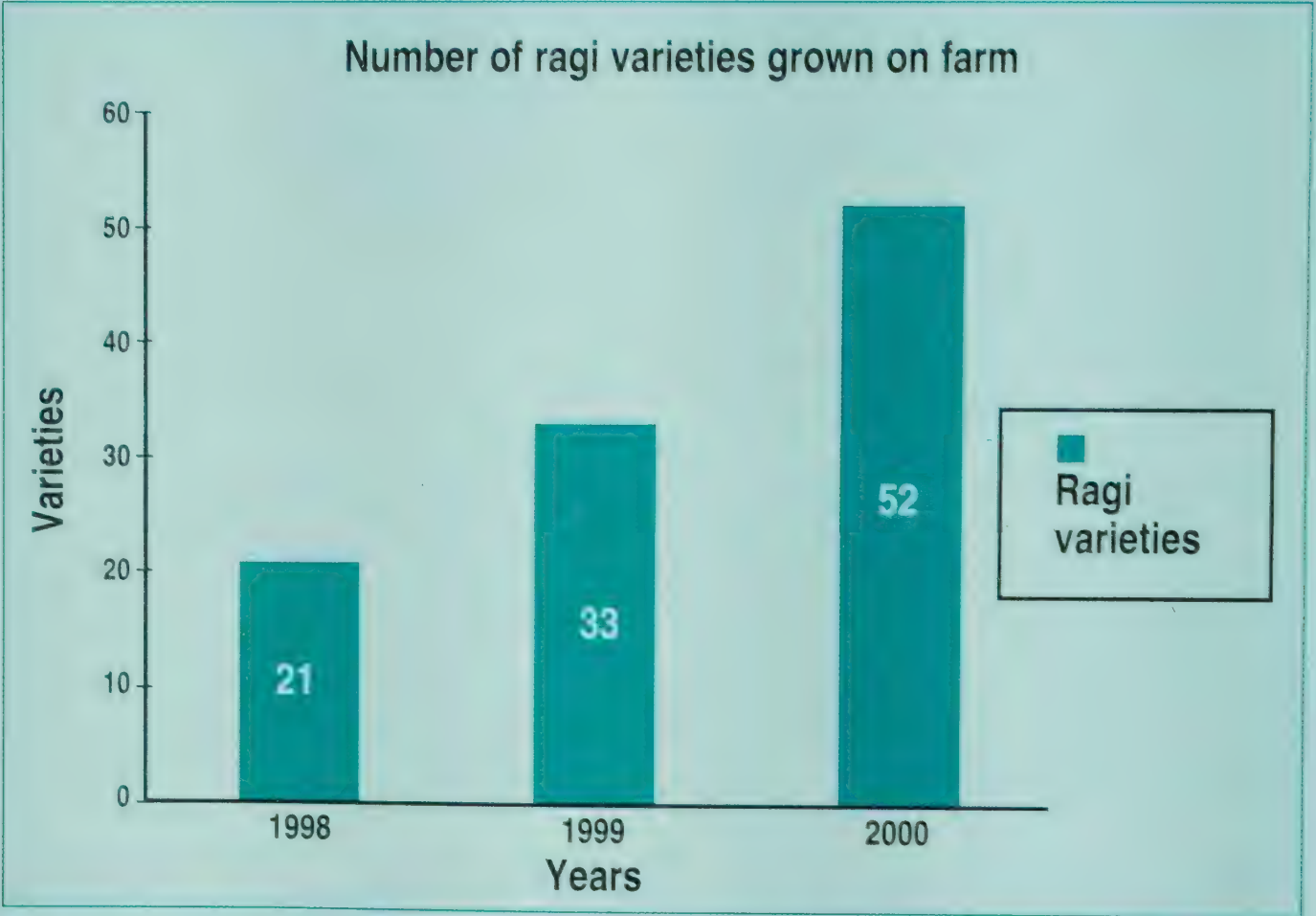
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There has been a consistent increase in the varieties that have been conserved by the farmers in the case of ragi and rice both wetland and dryland. The figures speak for themselves.

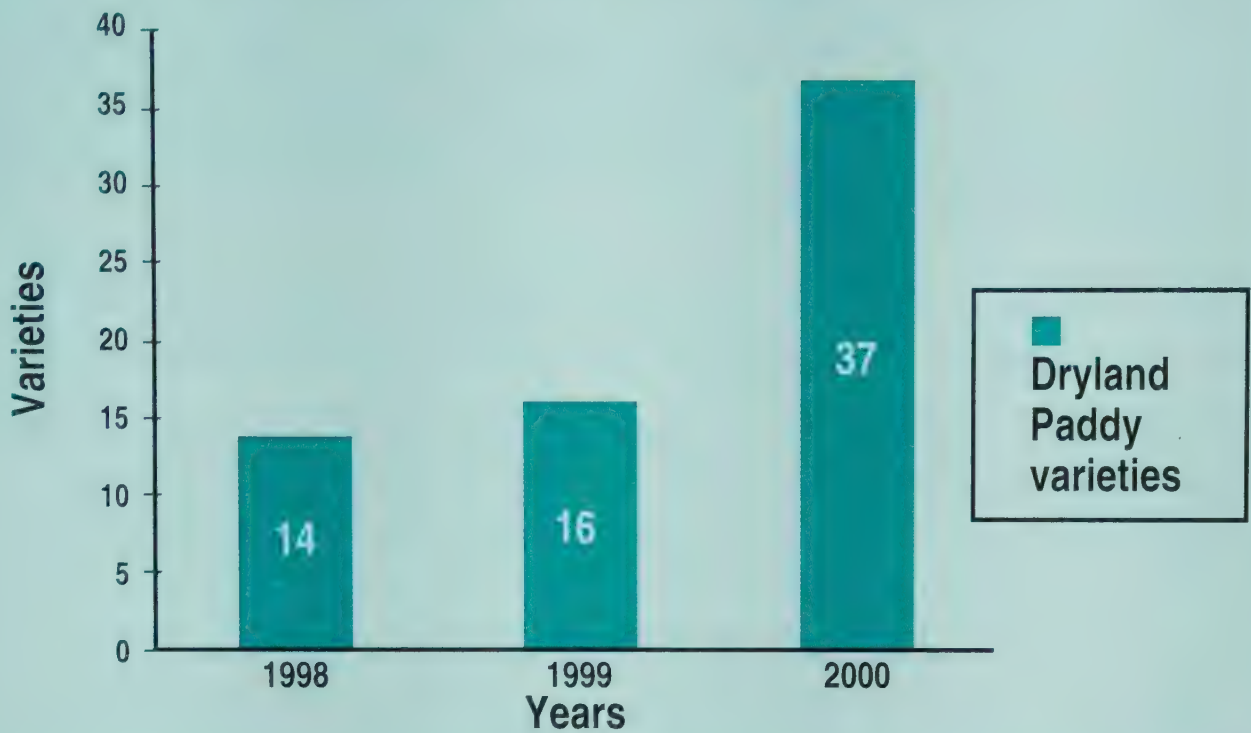
Years	1998	1999	2000
No. of ragi varieties	21	33	52



Finger millet

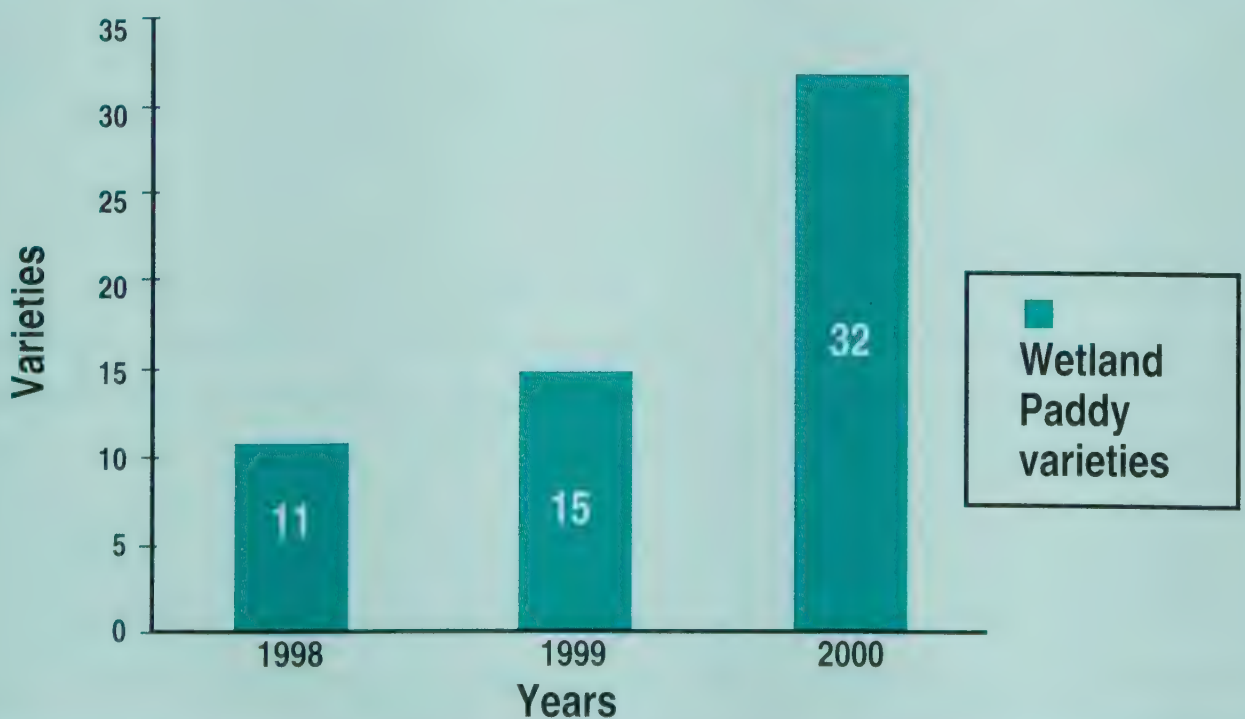
Years	1998	1999	2000
No. of dryland paddy varieties	14	16	37

Number of dryland paddy varieties grown on farm



Years	1998	1999	2000
No. of wetland paddy varieties	11	15	32

Number of wetland paddy varieties grown on farm



Managing the spread of indigenous cultivars

It is now recognized that farmers' varieties are morphogenetically distinct populations of a crop, selected and maintained as populations rather than as specific pure-line cultivars. It is for this reason that the indigenous varieties exhibit great intra-specific diversity and in some cases, inter-specific diversity as well⁷. The fact that landraces contribute to stable food production and income especially in marginal environments where the impacts of modern varieties is limited or less effective has been well documented.

Jarvis et al (1998)⁸ suggested that in situ conservation has great potential to: 1) conserve the process of local adaptation of crops to their environments, 2) conserve diversity at all levels - the ecosystem, the species and the genetic diversity within species, 3) improve the livelihood of farmers, 4) maintain or increase control and access of farmers over their genetic resources, 5) involve farmers directly in the value addition process, 6) integrate farmers into the national plant genetic resource system for conservation, and 7) maintain evolutionary processes.

The genetic diversity of the area had narrowed to only two high yielding varieties of ragi. However, over the last few years, from 1994 to 2001, farmers have broadened the genetic base by conserving 52 indigenous varieties. 37 varieties of rainfed paddy and 32 varieties of irrigated paddy have been added to the gene pool of the area. (See Appendix 2). Apart from seed conservation by individual farmers, the highlights of the seed conservation effort include: community farming by women, community seed distribution, training of farmers as seed keepers and an association of farmers who will be important in taking the movement ahead. Every year, farmers gather in different locations to celebrate their culture. The high point of these annual events is the 'seed mela'.

To sum it up, conservation of landraces is not just an exotic exercise. The aim is to link it with indigenous knowledge systems

⁷ Sthapit, Bhuwon, Percy, Sajise and Jarvis, Devra: *Strengthening scientific basis of in situ conservation on farm experiences from Nepal and Vietnam*, 9PG/RI

⁸ Jarvis, D I and Hodgkin, T (eds.) *Strengthening the scientific basis for in situ conservation of agricultural diversity on farm. Proceedings of a workshop to develop tools for in situ conservation on farm 25-29 August 1997, Rome*, 9PG/RI. (1998)

and endow it with the power of modern science in order to ensure self-reliance and food security.

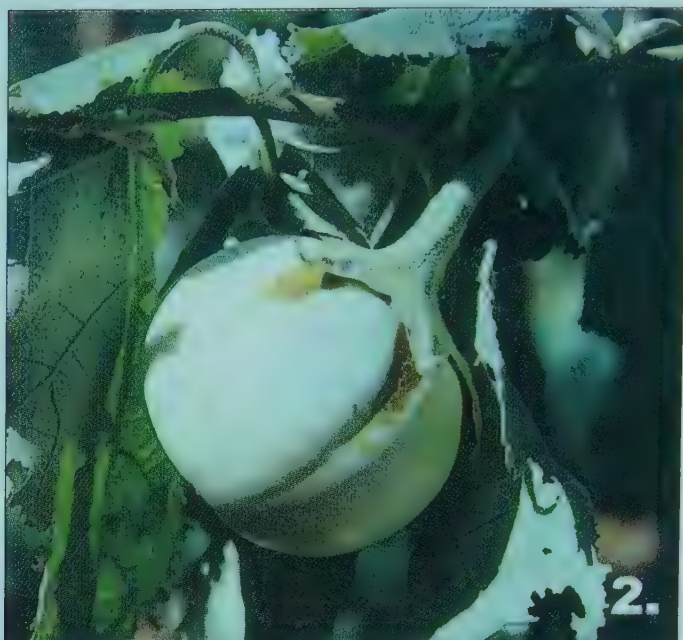
Some results

In 1997, a handful of 'Godavari', a wetland paddy variety, was grown by one farmer in Yerandapanahalli. By 1999, 25 farmers from this and surrounding villages had begun to multiply seeds of this unique wetland paddy. Dryland paddy, ragi and millet varieties are also being revived. On farm conservation of traditional crops, and marketing of the surplus seed varieties to fellow farmers has begun to re-establish itself in these villages. The objective of this conservation is the qualitative improvement of crops and sustainable livelihood systems.

A total of 794 farmers in 109 villages are participating in on farm conservation activities. Many other farmers have informally acquired the seeds from the conservation center. The traditional crop varieties revived cover a range of food crops like finger millet, dryland paddy, wetland paddy, pearl millet, sorghum, maize, little millet, foxtail millet, kodo millet and proso millet. Traditional varieties of beans, peas, greens, brinjal, tomato, red gram, green gram, black gram, horse gram, chilli, gourds, oil seeds and other vegetables have also been revived.

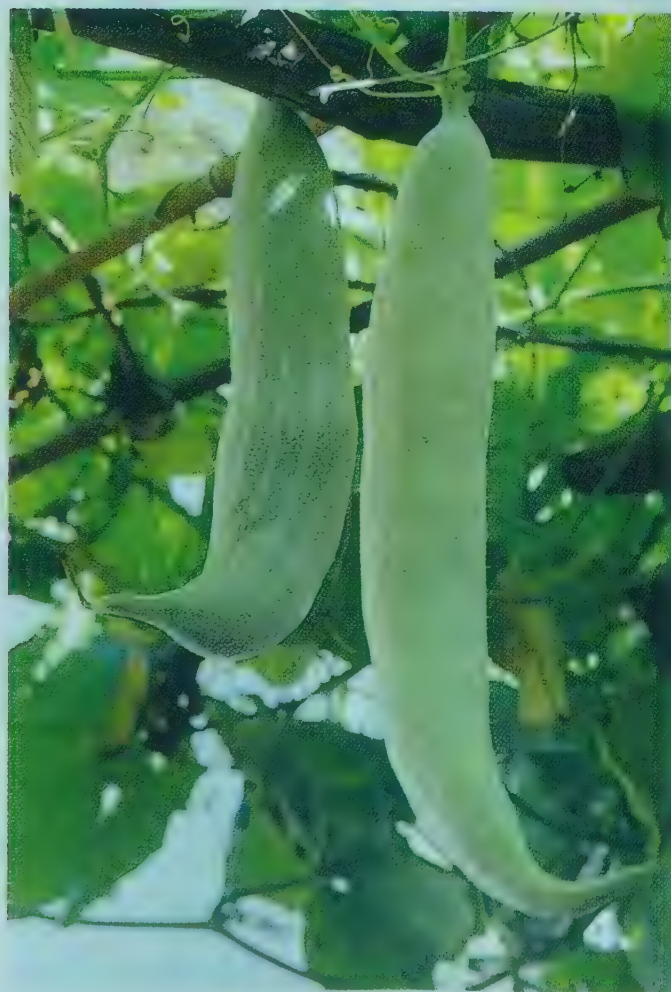
A new element of participatory plant breeding has been added. Farmers determine their selection criteria, such as high yield, medium-sized grains with good colour, resistance to pests and diseases, drought tolerance, sweet and starch content, non-lodging but of good height, good straw yield, late maturity, and other plant characteristics, such as number of tillers, and length and width of leaves.

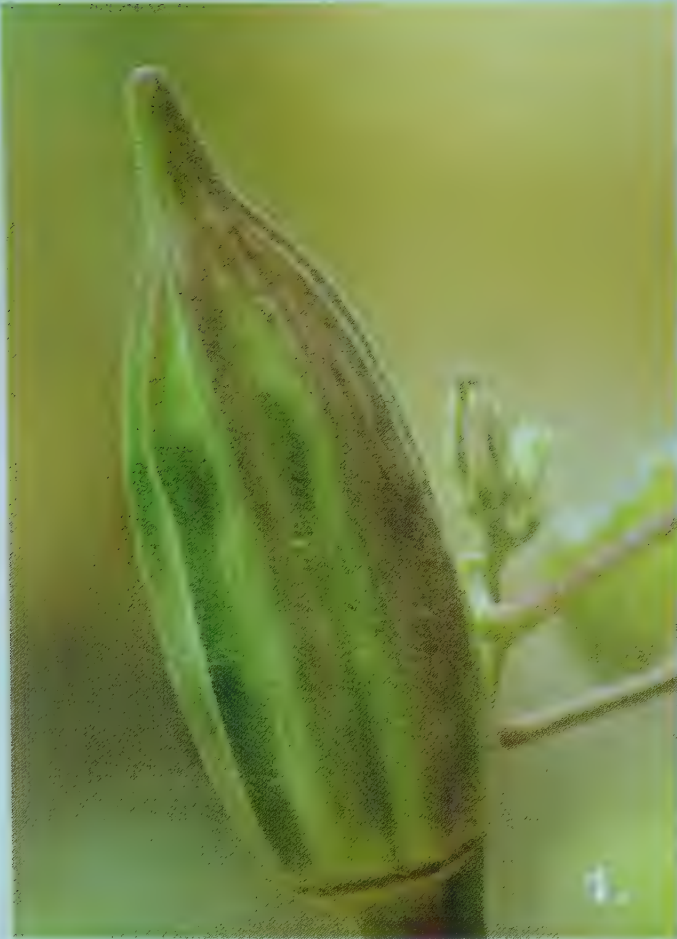
On the demo-farm seed varieties from other eco-regions have been collected and experimented with, to determine their viability and acceptability in the farmers' fields. Germination testing, close crop monitoring on the effect of drought, as well as pest and disease resistance, grain and fodder yield are determined. Presently the different varieties conserved in the seed bank are : 41 varieties of dryland paddy, 36 varieties of wetland paddy, 70 varieties of finger millet, 10 varieties of little millet, 6 varieties of sajje, 10 varieties of sorghum and 6 varieties of foxtail millet.



Diversity in indigenous vegetables

1. Creeper beans - 'Avare'
2. Green brinjal
3. Ethiopian gourd
4. Snake gourd
5. Bottle gourd





Diversity in indigenous vegetables

1. African okra
2. 'Gomukta Badame' - *Solanum tomentosa*
3. Sweet gourd
4. Field beans



From project to movement

The external evaluation performed in April 2000 concluded that, due to the efforts of Green Foundation, an appreciable increase in seed diversity has been established in the project region. Maintaining the enthusiasm of the farmers to retain the good elements of traditional practices also depends on the ability of the Foundation to facilitate a wider movement. This up-scaling needs to be done at several levels: at the village level, by strengthening the village level organizations, at the NGO level, by networking and experience sharing with other institutions, and at the general policy level.

The creation of sanghas, and village-level seed management committees and farmer seed conservation networks are ways of decentralizing and strengthening activities at the grassroots level. Green Foundation has also been networking with other NGOs and organizations, both in India and abroad. A strong farmers' network and strategic alliances are needed to bring about changes in general policy. This will further stimulate farmers to secure their livelihoods by conserving the genetic diversity of their crops and of the natural environment that surrounds them.

How has Green Foundation conceptualized and fulfilled its objective of reviving the cultural and bio-genetic diversity, both important aspects of endogenous development?

Green Foundation's approach has been:

- **Creating awareness and fostering bonds at the grassroots level through ways of communication that are culturally acknowledged and understood, combined with proactive involvement of the community in events such as the seed fairs.**

Rural communication is by and large oral, integrating various forms such as theatre, puppetry, ballads and folk dances. In trying to keep this tradition alive, Green Foundation uses puppetry and street theatre to create awareness on the issue of globalisation and its impact on farmers. Folk songs and dances that could be lost are revived during seed fairs, thus ensuring their continuation. Women go from one village to another after the harvest telling stories about the flora and fauna. During the seed fairs, Green Foundation honors these people who are the torchbearers of their culture.

- **Documenting indigenous knowledge systems and culture centered on diversity, which has become an ongoing and integral component of the conservation program.**

Indigenous knowledge represents successful ways in which people utilize the resources in their environment. In documenting indigenous practices a combination of methods is used including observations, participatory rural appraisals, guided field walks and obtaining reliable information from the elders in the villages. It is often found that form, content, language, and a host of other factors are not available to the local communities since cultural values have been eroded. Indigenous knowledge has a strong practical base, but sometimes a weak theoretical foundation. Unless a concerted effort is made to transfer the knowledge from oral form to written text, the next generation may have little available in the written form.

Green Foundation's approach has been to identify the most beneficial practices that are fast disappearing in a changing world, and revive them by involving different sections of the local population.

- **Using innovative methodologies like participatory rural appraisals (PRA) to record the oral culture.**

It is rather difficult to understand that people belonging to different cultures think and articulate differently. It is equally difficult for those with an urban bias to comprehend rural perceptions of the world. Hence, to comprehend people's expressions, Green Foundation uses different methods including participatory rural appraisals. Very simple tools are used. For example farmers evaluate different varieties and give them a rank according to various preferred criteria. This is done by drawing pictures on the floor. (See Appendix 3).

- **Revitalizing cultural practices such as ethno-veterinary cures and biodynamic methods to improve seed quality and soil fertility.**

Green Foundation's approach to revitalizing cultural practices starts with documentation but does not end there. If these practices are to be revived, it is necessary to experiment with these rituals, understand the subtle nuances and give them scientific validation. These have been the practical approaches to strengthening the efforts towards endogenous development.

Treating livestock using ethno veterinary practices is on the verge of extinction. The practice called ‘maddina madike’ which means ‘medicinal pot’ has been successfully revived in many villages by bringing the valuable medicinal plants to the attention of the farmers (See Box).

The leaves of the medicinal plants are soaked in a pot of water for several days. The water is then used to treat various ailments of livestock. By drawing attention to this practice, Green Foundation has also helped to revive the institution of indigenous healers in the local area.

‘Maddina Madike’

Nerale	<i>Syzigium sambulanum</i>
Sampige	<i>Michalia champaka</i>
Poovaracie	<i>Thespesia populnea</i>
Belisuli	<i>Breynea rhamnoides</i>
Honne	<i>Pterocarpus marsupium</i>
Neem	<i>Azadiracta indica</i>
Doddamara	<i>Allanthus excelsa</i>
Ealachi	<i>Zizupus jujuba</i>
Honge	<i>Pongamia pinnata</i>
Mango	<i>Mangifera indica</i>
Halale	<i>Terminalia chebula</i>
Kaadu malige	<i>Jasminium folium</i>
Keru nelli	<i>Phyllanthus niruri</i>
Kagali	<i>Acacia catechu</i>
Menasu	<i>Piper nigrum</i>
Earamadina gida	<i>Withania sominifera</i>

Similarly, seed treatment for withstanding stress and ensuring early germination has been documented after experimentation. A successful method of treating seeds to improve the germination rate is the salt water treatment. The density of salt water is standardized using an egg, which is allowed to float in it. In this salt water, paddy seeds are soaked for 30 minutes before sowing. This method is found effective not only in improving seed germination but also in controlling blast disease. Green Foundation has initiated the revival of such practices wherever they have been eroded.

Green Foundation has not only intervened in reviving and strengthening lost practices but has also added value to people's eroding knowledge. Appropriate knowledge including biodynamic farming has been added to farming practices in the cultivation of rice. The genesis of biodynamic farming goes back to the early part of the last century when Rudolf Steiner explained the relationship of the earth and soil with the formative forces of nature. He emphasized that the health of the soil, plants and animals depended upon interconnecting nature with the cosmic creative forces, which is very similar to the vedic and folk knowledge that existed in the Indian subcontinent.

Venkatashetty, a farmer from Puttadasadoddi has adopted biodynamic methods of cultivation in his quarter acre of wetland. At all stages, from land preparation to harvest, various preparations like the BD 500, 501, cowpat pit manure pest control spray are used. BD 500, farm yard manure and green manure are used in land preparation. BD 501 is used one month after transplanting and at the time of flowering. The cowpat pit manure spray is used once a month until the crop is harvested

Strengthening endogenous development initiatives by creating institutional structures and human resources at the grassroots level.

Strengthening village level organizations is a central element of Green Foundation's methodology. Distribution of indigenous seed varieties was first conducted from the Green Foundation's biodiversity conservation center in Thalli. Later, the aim became to strengthen and promote decentralized systems of seed distribution. The villagers have chosen to revive or start farmers' sanghas, an old type of village level organization. The general membership of these groups is between 15 and 25. Very often these are "women only" groups. Members of the sanghas are represented in the village seed committees.

The village level organizations develop their own initiatives and act accordingly. They identify seed requirements for the following year and select and purchase their stock from the savings of sangha members. In each of the sanghas, a central

storage room has been identified, and seeds are conserved using traditional methods. Sangha members contribute towards room space for seed storage and purchase of storage devices.

It is important to include women in these village level organizations since women play a very crucial role in agriculture as well as in all walks of life. When it comes to decision-making and social positioning, however, they are often marginalized. In the power relationship between men and women, they are at the receiving end. There is an increasing awareness among women about the need to conserve biodiversity and local knowledge base. For example, the Sharada Mahila Sangha, a women farmers' group, has taken the initiative in purchasing and storing seed varieties of wetland paddy, dryland paddy, and finger millet. This group also has a savings and credit program.

Bio-cultural seed village

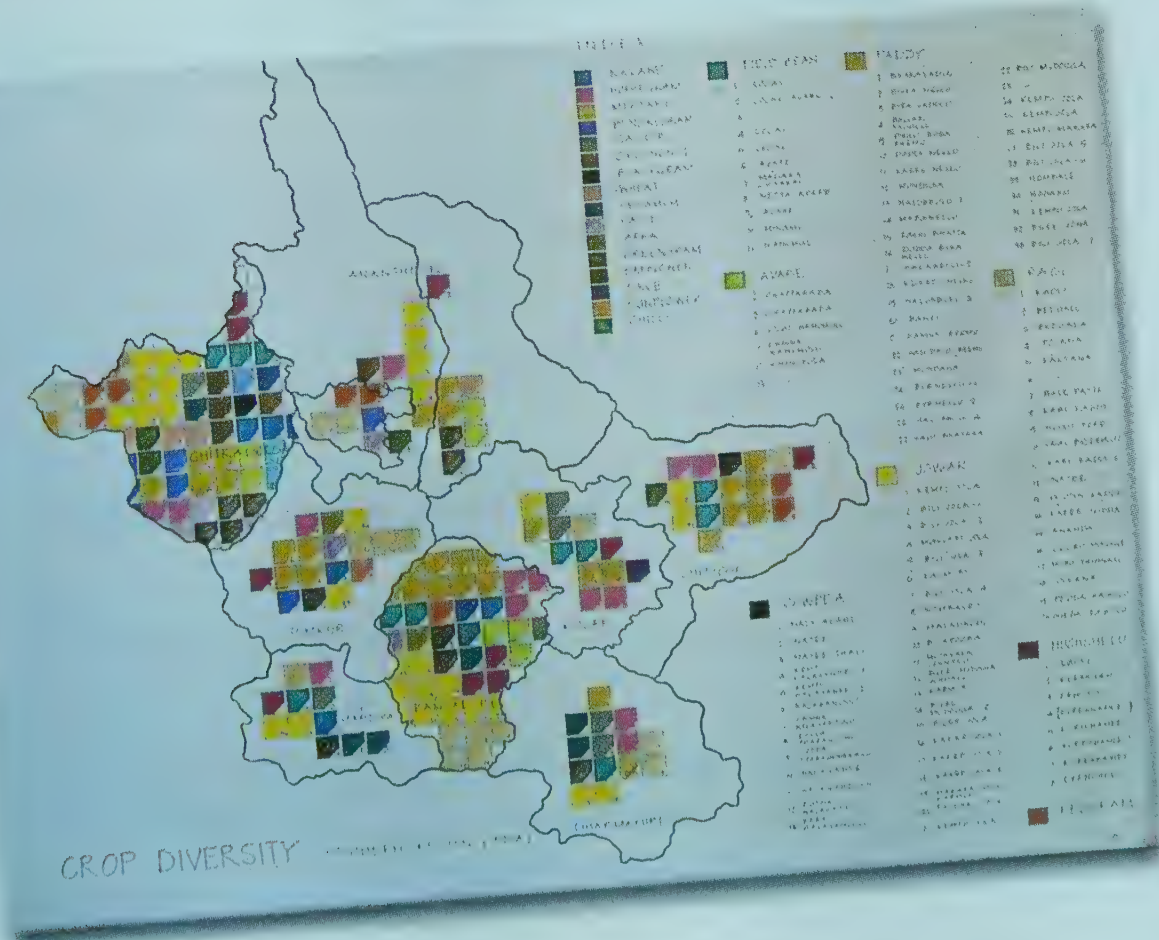
The concept of the 'bio-cultural seed village' as a single market area, and center for endogenous development, has been developed over the years. Laxmipura, a village approximately 20 kilometers from Thalli, was identified as ideal, as it is located in the midst of indigenous communities and tribal groups. Initiatives undertaken in this village include community organization, seed conservation, strengthening health traditions, promoting kitchen gardens, reviving the cultural heritage, children's activities and marketing. The local sangha is now promoting on farm conservation and multiplication of traditional crops, such as paddy, navane, areca, chillies and red gram.

A community hall has been restored and painted for the sangha meetings. Vermi-composting using earthworms has been adopted by some of the farmers in the area. Village level mapping of Laxmipura and the surrounding villages has been done and the village level biodiversity register completed and handed over to the headman of the village in the presence of other villagers. A herbarium of medicinal plants has also been compiled, to cater to the growing health requirements of the farming communities. A children's group is growing indigenous crop varieties of paddy, finger millet and vegetables on community lands.

Networking

Networking takes place at various levels. The networking activities between the different villages and farmer groups within the project area are stimulated by the dissemination of the quarterly newsletter 'Pairu Pacche' (seedling) in the local language. This publication contains first hand information about traditional practices and rituals, local technologies in agriculture, available indigenous seed varieties, and upcoming exchange events and seed fairs. This newsletter also describes experiences gained from the various Compas projects, and invites the readers – farmers, like minded individuals and organizations to share their knowledge. Other publications in the local language include the agricultural calendar, with details of auspicious days for agricultural activities, and posters on specific themes, like linking culture to livelihoods.

Green Foundation also networks with other organizations in Karnataka such as VGKK, (Vivekananda Girijana Kalyana Kendra) which is working with the Soliga tribals in the hills of Mysore, and focuses on on farm conservation of agri-diversity and indigenous knowledge. Several meetings have taken place, at the national and international level with the Compas partner organizations to compare the strategies and the insights gained in the different continents.





Protecting biodiversity and sustainable livelihood systems

India has been named as one of the twelve mega biodiversity countries in the world. Biodiversity is the lifeline of sustainable livelihoods and its conservation should not be taken for granted. With the disruption of life and destruction of the culture that supported sustainable systems of production and consumption, the threats to biodiversity have become threats to survival itself.

It is also well known that diversity of ecosystems, life forms and ways of different communities is under the threat of extinction due to the pressures of economic progress. Erosion of biodiversity sets off a chain reaction. With the disappearance of a species the survival of many related species is also threatened. Biodiversity erosion leads to ecological and social vulnerability.

Causes for erosion of biodiversity

- ❖ Habitat destruction caused by the building of dams and highways, mining operations in areas that are rich in biodiversity like the forests.
- ❖ Modern agriculture, which uses intensive chemicals and replaces biodiversity with monocultures of commercial crops.
- ❖ Expansion of human settlements.
- ❖ Over exploitation of plant and animal species for commercial purposes.
- ❖ Undermining local democratic systems of protecting common property resources by the communities.
- ❖ The emergence of the IPRs that create conflicts over ownership of natural resources.
- ❖ The emergence of biotechnology that appropriates the components of life for newer inventions and the claim of ownership over the process and the product.

Biodiversity has multiple uses. Communities have identified the ecological niches in which conservation takes place and the special meaning in the cultural context in which it happens. For example there is symbolic worship of sacred groves, sacred seeds and sacred species. Local communities place sustainable economic values on the consumption for survival and on ecological support mechanisms such as soil, water and species conservation.

Agricultural communities have, in the last several centuries, developed in-depth knowledge of crops, the agro climatic conditions in which they have to be grown and the specific properties of drought and pest resistance of different crops. Farmers in dryland cultivation, despite the constraints under which they have worked, have maintained diversity. Keeping biodiversity alive has been a challenge they have met, in order to ensure their food security.

Recent developments in international trade regimes have posed new threats to the conservation of biodiversity. Patents and intellectual property rights have been defined by the WTO only to empower the corporations who are exploiting biodiversity for commercial purposes. Natural resources like seed, plants, genes, cell lines and soil microorganisms are being brought under the purview of the TRIPS of the WTO.

This is explicitly noted in article 27.3 which states:

Members may also exclude from patentability

- a) Diagnostic, therapeutic and surgical methods for the treatment of humans and animals;**
- b) Plants and animals other than microorganisms and essential biological processes for the production of plants and animals other than non-biological and microbiological processes.**

However members shall provide for the protection of plant varieties either by patents by an effective sui generis system or by any combination thereof. The provision of this sub paragraph shall be reviewed four years after the date of entry into force of the WTO agreement.

Patent has been defined as an exclusive right to make, sell, and distribute the patented product. Exclusive rights over life forms like seeds, livestock or medicine can be a threat to the basic needs of the people. In a similar fashion all biodiversity related knowledge, which is the result of collective innovation by communities, is also being brought under intellectual property regimes.

Community Biodiversity Registers

To counter the appropriation of biological wealth and knowledge, one of the efforts undertaken by NGOs in various parts of the world is the reinforcement of community intellectual rights. In international law the Convention on Biological Diversity (CBD) is perhaps the most comprehensive document. The Convention that came into force in 1993 has today a membership of over 170 countries. However, the stated objectives are still to be put in place. In its 42 articles the Convention deals with several issues of biodiversity which are broadly encapsulated in the three main objectives of the convention:

- ❖ **Conservation**
- ❖ **Sustainable use**
- ❖ **Equitable sharing of benefits arising from biological resources**

The CBD gives countries the rights to their biological resources and the indigenous knowledge related to biodiversity. According to the CBD, each country which is a party to the Convention shall, subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovation and practices.

A Community Biodiversity Register (CBR) is the documentation of the resources and knowledge of local communities at the local, regional and national levels by the people themselves. This is done for the purpose of rejuvenating the knowledge and conserving biodiversity. The CBR is a tool for keeping the knowledge of biodiversity alive in the community. The Biodiversity Register can also be seen as a political tool to empower people and bring about awareness of their rights to the resources.

In an effort to foster endogenous development Green Foundation has initiated a people's Biodiversity Register. People from the different villages of a panchayat have compiled the agricultural knowledge and diversity existing in these villages. The effort has been initiated by the Jeeva Vaividya Samrakshana Samithi (Biodiversity Conservation Committee).

Focused on biodiversity as the basis of livelihoods of the rural people, efforts have been made to map diversity, revive lost genetic resources and add to the gene pool of the area. The revival of genetic resources has been undertaken taking into consideration cultural, social and political issues.



Community seed bank

Steps in the preparation of the Biodiversity Register

Creating a Biodiversity Register is an ongoing process. Green Foundation has started with individual villages and intends to cover an entire panchayat. The process goes through the following steps:

Step 1 - A number of village elders, influential persons and opinion leaders are contacted and the concept of a Biodiversity Register is explained to them.

Step 2 - From this group a committee is formed and named the Biodiversity Management Committee (Jeeva Vaividya Samrakshana Samithi).

Step 3 - From the group of village people who would be actually involved in the listing of biodiversity the People's Biodiversity Conservation Corps is formed.

Step 4 - In order to create awareness and ownership of the resources among the people, an inventory of the local biodiversity resources has to be made. To do this, a resource map of the village is created, using the participatory rural appraisal method.

Step 5 - The area from which the data is to be collected is identified and the boundaries are marked. The documentation is done with the help of knowledgeable persons in the village.

Step 6 - When the documentation in all the villages in the panchayat is complete, the people of the panchayat are brought together in the presence of the village administration, and the district authorities declare it as the right of the people to protect their natural resources and biodiversity.

This means that the nature of ownership can be defined and its content determined. This also means that the present members of the community hold the rights, as custodians, for past, present and future members of the community. This also necessarily means that any invention derived from the resources cannot be claimed as any right of private property since it is already in the public domain. For people dependent on the multivarious uses of plant and animal diversity, conservation is a living experience.

Salem sanna (WLP) Majjige ragi	SINGEGOWDA	Seed Village Yerindyapana Halli 2001-2002	VEERABHADRA SHETTY	Majjige ragi Raskadam
Raskadam Gandhasale	RAMEGOWDA		MUNIYAPPA	Salem sanna Basumathi
Khichdi samba	MUNEERAMMA		GOPAL SHETTY	Majjige ragi Raskadam
Salem Sanna Raskadam	PUTTASWAMY H		BASAVARAJU	Annekombina Batha
Gidda Ragi	RAJU		NANJAMMA	Majjige ragi
Godhavari Isuku vadlu	BASAVARAJU		JAYARATHNAMMA	Gidda ragi
Raskadam	V D SURESH		PUTTAGOWDA	Jenumuthige ragi
Raskadam	VASANTHA		MAREGOWDA	Gidda ragi
Giddha ragi Godhavari Isuku vadlu	MUNIMADAIAH		MUNEERAIH	Ambukavi
Majjige ragi	KUMAR		SHIVARAJU	Pichakaddi ragi
Gidda ragi Rathnachudi	DYAPEGOWDA		KUMAR	Rathnachudi
			KENCHAPPA	Raskadam



List of vegetable seeds in the community seed bank

1. Rice bean
2. Okra
3. Creeper bean
4. Double bean
5. Pandal bean
6. Red gram
7. Sunflower
8. Radish
9. Ramdhan
10. Greens
11. Spekai bean
12. Brinjal
13. Juice fruit
14. Lemon grass
15. Tomato purple
16. Pumpkin
17. Bottle gourd
18. Ridge gourd
19. Bitter gourd
20. Cucumber
21. Winged bean
22. Carrot
23. Tree potato
24. Tomato big
25. Sword bean



Biodiversity - the basis of nutritional adequacy and food security

Food security has been on the agenda of developing countries for a long time now. Countries in the Asian region have taken pride in participating in the Green Revolution and producing surplus food. Yet, in these countries today, a large per cent of their population suffers from chronic malnutrition and poverty. It is obvious that these countries have achieved neither nutritional well being nor food security. This state of affairs raises many questions. What exactly is food security? Is it surplus food production? Or is it access to food for the entire population? Is it producing for the growing urban population? It is always construed that low and stagnating productivity in agriculture is what contributes greatly to existing poverty and food insecurity across the developing world. Can centralised food production systems provide food security? Can monocultures of cereals grown with high external inputs be sustained over a long period? The logic of economies of scale and the elusive logic of the market - are they compatible in providing food security?

National food sovereignty and global trade - can they have a common goal? Privatization of life and genetic engineering - are they justified in meeting the goals of food security for the poor and marginalised? Will biotechnology and genetic engineering fulfill the promise of feeding the growing population or will they compound



the problem? These and many other related questions have no straightforward answers and the absence of adequate information cannot be taken as affirmation and consent.

What is the answer to providing food security? The idea that biotechnology will solve the world's problems of food and nutrition is founded on myths that are being promoted to mislead the common person. In order to justify the introduction of genetically engineered varieties, it is argued that this technology will feed the growing millions who are undernourished. Time and again it has been pointed out that as long as social inequalities are perpetuated, merely increasing food production cannot reach food to the poor. If it were true there would be no need for the supreme court in India to observe that the food grains overflowing in the godowns should reach the starving people. There are an estimated 208 million under-nourished people in India. 26 per cent of India's millions have been identified as being below the poverty line and requiring subsidized food grains.

Unfortunately, nutritionists define malnutrition very narrowly as a condition resulting from the deficiency or excess intake of nutrients. There is evidence from the National Family Health surveys to show that 47 per cent of children under the age of 4 years are underweight for their age and 13 per cent are severely underweight. They also point out that prevalence of vitamin A deficiency and other forms of nutrient deficiencies are high amongst the vulnerable groups. The poverty-population nexus is said to be the main cause of the malady. While it is clear that the nature of the problem is purely social and economic, the solution offered is solely a technical one. For long we have bought the argument that increasing production will solve the problem of food, but the outcome of the Green Revolution or the White Revolution in the country does not support this. While recommending a technical solution we have often forgotten the market mechanisms that play a major role in the demand and supply. Even today it is the subsidy phenomenon that has made possible the cheap food produced on a large scale for the urban population. It is not only the nature of the chemical inputs that is short term in its goal of food production but also the subsidy that is given to achieve this goal which is reaching the producer

of the chemicals and not the producer of the food. The heavy burden of external debts and the ecological destruction of the natural resources, which is the capital base of the farmers, is borne by the producers. Indebtedness has increased to such an extent that agriculture has been rendered unsustainable and unviable.

There is also the belief that people have to be educated because there are gaps in the knowledge base of the people about the complexities of biology. This popular myth about people's ignorance has been well stated by the famous biologist Rupert Sheldrake⁹ who says, "I was taught that direct intuitive experience of plants and animals was emotional and unscientific. According to my teachers, biological organisms were inanimate machines, devoid of any inherent purposes; the product of blind chance and natural selection and indeed the whole of nature was merely an inanimate machine-like system." He adds further, "from the time of our remotest ancestors, it was taken for granted that the world of nature was alive. But in the last three centuries growing numbers of educated people have come to think of nature as lifeless. This has been the central doctrine of orthodox science - the mechanistic theory of nature."

The fact that biodiversity in food production ensures nutrition needs no emphasis. There is a thin line that separates nutrition and medicinal value. Scriptures speak of many varieties of rice which include 'gandha sali' or perfumed rice, 'rakta sali' or red rice and 'sookma sali' or small rice. Similarly scholars who traveled in the state of Karnataka in 1880 speak of different varieties of paddy such as 'dodda batha', 'kembuthi', 'yelakki raja' and so on¹⁰.

Traditional agriculture in India is one of the oldest and most advanced forms of food production. It has proved to be inherently sustainable over centuries and rates high in all aspects of total productivity, self-reliance, diversity and the depth of its indigenous knowledge.

⁹ Sheldrake, Rupert: *The Rebirth of Nature*. Century. (1990)

¹⁰ Iyer, Yagna Narayana: *Agriculture in Karnataka*. (1945)



Traditional practices did not simply exist as a result of some divine revelation. They were, on the contrary, the result of an understanding of the mechanisms of nature; the result of a science that was accessible to people on a day-to-day basis and not of one confined to a laboratory. This involvement of the practitioners themselves played an important role in making the system sustainable. The 'Navadanya' and 'Baranaja' systems of multicropping elucidate the nutritional balance derived. The minor millets which have been given the status of crops of low value have unique nutritional value. The Table below gives details of the nutritive components of the millets as against the popular crops like rice. The Table also describes the nutritive value of the uncommon greens, which are a source of nutrition for the poor.

Nutritive value of crops (per 100 gm.)

Crop	Protein	Calories (mg.)	Calcium (mg.)	Iron	Vitamin A
Ragi (Finger millet)	7.3	328	344	3.9	42
Bajra (Pearl millet)	11.6	361	42	8.0	132
Jola (Sorghum)	10.4	349	25	4.1	47
Udulu (Barnyard millet)	6.2	307	20	2.9	
Navane (Fox tail)	12.3	290	37	12.9	
Arka (Kodo)	8.3	309	27	5.0	
Samai (Little)	7.7	341	20	9.3	0
Amaranth	16-19	366	25-389	3-22	14,190
Rice	6.8	345	10	0.7	0

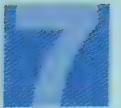
Examples of leafy vegetables having high levels of carotene

Leafy vegetables	Carotene (mg.)
Agathi	5400
Amaranth, <i>tender gangeticus</i>	5520
Betel leaves	5760
Carrot leaves	5700
Coriander leaves	6918
Cow pea leaves	6072
Curry leaves	7560
Drumstick leaves	6780
Radish leaves	5295
Spinach	5580

Farmers have contributed to the continuity of genetic diversity and the dynamic conservation of landraces. The informal system has relied on the skills of farmers in maintaining, enriching and utilizing the crop diversity. The main selection criteria are yield stability, risk avoidance, low dependence on external inputs and a range of factors associated with storage, cooking and taste.

An area in which biotechnology plays a major role is the selection and breeding of crops. The basic need is to conserve and improve hardiness, nutritional value and yield of diverse crops used by the poor. The dominant research focuses on, for instance, gene transfer for drought resistance, pest resistance or herbicide resistance. All these exclude the possibility of rotational, mixed cropping and the diverse farmers varieties that are the basis of sustainable and ecologically balanced forms of agriculture and food security. With the kind of genetic diversity that can be accessed by farmers and the diverse knowledge system of farmers is there really a need for genetic engineering?

Science today identifies specific qualities of seed varieties such as pest resistance, drought resistance and yield. This is predominantly seen in the inter species and intra species diversity.



Some simple truths about farmers' varieties:

- ❖ While improved varieties have a higher yielding potential than the farmers' varieties, the yield potential cannot be achieved in resource poor environments. Farmers use locally adapted varieties or mixtures of varieties by which they are able to spread the risk of crop failure resulting from pest and diseases or drought. Farmers' varieties are well adapted to diverse conditions.
- ❖ In highly variable environments the farm production is obtained from growing a range of crops adapted to the microenvironment.
- ❖ Intercropping provides the balance in the food consumption while agro forestry takes care of the needs of fodder and fuel. Crop combination enriches soil fertility and allows for judicious use of soil nutrients by the different crops.
- ❖ Women's knowledge is captured in choosing the crop combinations that ensure food security.



Some of the farmer's varieties that have some unique qualities of pest resistance, high yield, and drought resistance are listed in the Table:

Indigenous paddy varieties with unique qualities

Wetland paddy varieties

Sl. No.	Variety name	High yield	Drought resistance	Pest resistance	Cooking quality	Rat resistance
1.	Salem sanna	▲				
2.	Thooya malli	▲				
3.	Rathnachoodi				▲	
4.	Kichadi samba				▲	
5.	Rajamudi				▲	
6.	Halluballu					▲
7.	Kullanakar		▲			
8.	Basumathi				▲	
9.	Honnekathu			▲		
10.	Pichchana kar			▲		

Deep water rice varieties

Sl. No.	Variety name
1.	Neeru mulagana batha
2.	Laxmikajal
3.	Nere guli

Salt tolerant paddy

Sl. No.	Variety name
1.	Meese batha
2.	Toke batha

Ragi varieties

Sl. No.	Variety name	High yield	Drought resistance	Pest resistance	Cooking quality	Good fodder
1.	Uganda ragi		▲	▲		
2.	Dodda ragi			▲		
3.	Mandya (Orissa)	▲				
4.	Kari kaddi ragi				▲	
5.	Sanna kaddi ragi	▲				
6.	Beli munduga	▲				
7.	Mitta ragi	▲				
8.	Piccha kaddi		▲			
9.	Majjige ragi				▲	
10.	Mandayyanagiri ragi					▲
11.	Kona kombina ragi					▲

Foxtail millet varieties

Sl. No.	Variety name	Special characteristics
1.	Jade navane	Long earhead, good yield
2.	Kuchchu navana	Big sized earhead, good yield
3.	Kohilu navane	Short duration
4.	Kari navane	Black colour variety, rare

Little millet varieties

Sl. No.	Variety name	High yield
1.	Dodda same	▲
2.	Hejjamme	▲

Pearl millet variety resistant to bird attack

Sl. No.	Variety name
1.	Mullu Sajje

The traditional cropping patterns have helped in pest control. Since many of the pests are specific to particular plants, planting different crops in different years causes large reductions in pest populations. Such cropping systems require less irrigation, which has been found to prevent the spread of the pests. In the light of this do we really need pesticide resistant genetically engineered crops ?



Traditional pest management practices

Farmers have innovated techniques to control pests and have successfully avoided the use of chemicals. Some simple examples:

Caseworm control in paddy

If Caseworms appear in the paddy field, the water is drained out. *Gliricidia* leaves are broadcast in the field. 2 teaspoons of pongom oil, 2 teaspoons of neem oil and 3 teaspoons of soap powder are mixed well in a bucket (10 litres) of water. This mixture is sprayed 3 times with intervals of 2 days. The fields are kept clear of standing water.

Stem borer control in paddy

In the growth stage, paddy is most vulnerable to pests. Stem borer and leaf roller moths lay their eggs on the plant. Farmers use traditional methods for pest management during this period, which are very interesting:

- ❖ A fire is lit next to the paddy field in a spot from which the smoke will blow on to the paddy. Some bones are placed on the fire. Farmers believe that this smoke chases away the pests.
- ❖ Spiders are encouraged to spin webs in the paddy field. Flying insects such as the stem borer and leaf roller moths are trapped in these webs and can easily be controlled.

Castor: Control of semi looper

Semi looper is the major pest in castor. These caterpillars eat the leaves and can strip the plants down to skeletons overnight.

The farmers of Thalli practice a very interesting method of pest control. They go to the field, carrying a small bowl of water with them. They pick the caterpillars and put them in the water. Later, the caterpillars are buried in a pit.



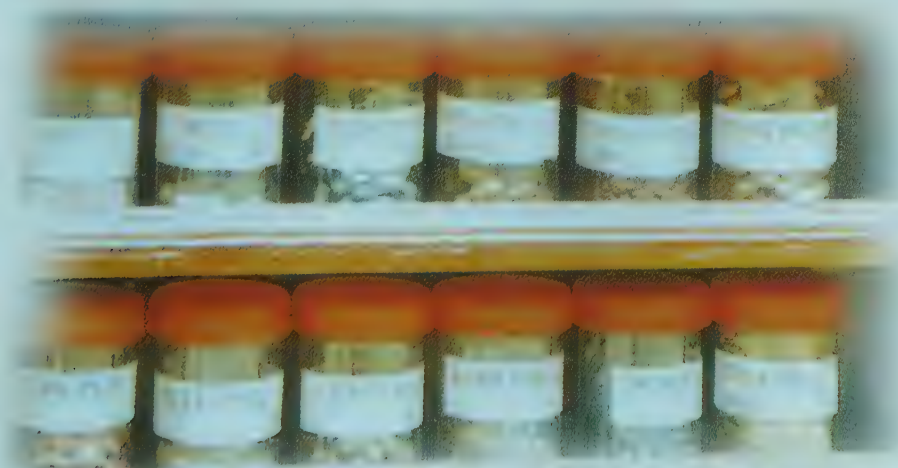
Root rot control in groundnut

Young seedlings of groundnut suffer from root grub and root rot problems.

To prevent these, the farmers crush 1 kg of neem leaves and extract the juice. They put 4 - 5 leaves of *Agave Americana* (Kathale) in the fire for a few minutes, then squeeze and extract the juice. The neem and *Agave Americana* juice is mixed in 1 litre of cow's urine and left overnight. Next morning the solution is filtered and mixed with 10 litres of water. This diluted solution is sprinkled on the groundnut before sowing. This innovative method of pest control was discovered by farmer Siddegowda of Kunigal.

The promises of genetic engineering

It is clear that a broad genetic diversity is an absolute must for sustainable food production. Genetic engineering promises that the quality of crops will be improved and perfected. The technology promises to feed the growing billions. The technology also promises pollution free cultivation. Speaking about the role of genetic engineering, Dr Mae Wan Ho from the Open University in UK refutes the need for genetic engineering to feed the population on the count that there is scientific evidence of actual and potential hazards of GMOs on health and the environment. There are several arguments to give evidence to the fact that organic agriculture should be free of genetic engineering. This technology basically changes the genetic make up of the plants and animals within the confines of a laboratory. The transgenic experiments involve the transfer of genes from one species to another using vectors like the virus or bacteria since the construction of artificial vectors is fundamental to genetic engineering.



Common arguments against genetic engineering

- ❖ **Scientists in favour of genetic engineering use the argument that if most characteristics of genetically engineered foods are similar to their non-genetically engineered counterpart, then they are comparable, though this is clearly not the case. Long term trials are avoided since they are expensive and time consuming.**
- ❖ **Genetically engineered foods can be hazardous for people because of the unintended side effects. The technology is too new for long term effects to show up. Until long term human trials are done, no one can give a 100 per cent assurance that genetically engineered foods are safe to eat.**
- ❖ **Use of antibiotic – resistant genes in biotechnology can confer resistance to the drugs that help fight infection and diseases. Genetic engineering works on the principle of horizontal gene transfer. Many scientists have expressed concern that widespread planting and consumption of genetically engineered food will lead to a massive release of antibiotic-resistant genes.**
- ❖ **Genetically engineered foods present a false appearance of being fresh while they remain on the shelves for a long time gradually being depleted of all the nutrition.**

An excellent example of the application of genetic engineering to alleviate human misery has been claimed by the biotech industry.

From a news release issued on May 16, 2000, Zeneca Ag products:

“A collaboration is announced today that will help fight blindness in developing countries through the use of genetically modified rice. The collaboration will help the inventors of ‘Golden Rice’ to deliver their gift of nutritionally enhanced rice to the developing nations of the world, bringing closer the health benefits for countries where Vitamin A deficiency is the cause of 50,000 cases of irreversible blindness each year.

The inventors of Golden Rice have reached an agreement with Greenovation and Zeneca and are working with other agencies throughout the world to enable the delivery of this technology free of charge for humanitarian purposes in the developing world. This will bring closer the 1982 vision of the Rockefeller Foundation, which stimulated and funded this research into rice varieties that might offer global public health benefits."

Michael Pollan, in his new book to be published, "The Botany of Desire" has taken a critical look at the claims of the biotech industry. Pollan says that, "watching the pitch of the advertisement and claims made by the industry, one can almost feel the moral ground shifting under one's feet. The unspoken challenge he says is that if we don't get over our queasiness about eating genetically modified food, children in the third world will go blind." It is observed that an eleven year old would have to eat 15 pounds of cooked golden rice a day to satisfy the minimum daily requirement of vitamin A.

Apart from the many imponderables on the usefulness of the golden rice to solve the problem of vitamin A requirement in children there remains the fact that the health consequences of malnutrition extends also to iodine, iron, vitamins like the B and C, calcium and many other micronutrients. There is no quick fix or magic solution to solve the problem of inadequate nutrition.

Rice eating populations have always consumed various sources of Vitamin A that were easily available to them in the form of undervalued and underutilized plants grown in their own fields. With the coming of the chemical applications the uncultivated source of nutrition was totally lost to the people. What were termed weeds by the scientific community have provided the much needed source of various nutrients that go with the subsistence food. Women depend upon uncultivated foods to meet their nutritional needs.

Green Foundation's experience in conservation of diversity has gone beyond the debate of "can indigenous varieties feed the growing population?" by broadening the concept of food security for the small and marginalised who are the custodians of diversity.



Knowledge forms, conservation, ecology and rituals

The lives of rural people are influenced in no small measure by the biodiversity which pervades their environment - the great circle of life, as it were, is fuller here than anywhere else. All living beings exist in a state of continual vibration and the five elements of nature constitute the continuum of energy, from its densest, grossest vibration level to the subtlest, thus completing the cycle from birth to death. Rural people living in close contact with nature contribute to the conservation of biodiversity and all life forms, reinforcing the fact that all life forms are made up of the five elements and eventually decay into the five elements, thereby subscribing to the perceptions of the cosmic interconnectedness of all life. To openly embrace Nature in this way as the spirit that unites all beings means to worship Her and never violate Her unwritten rules.

The interconnectedness of all beings is the basis of life. The ability to separate the observer from that which is being observed has given shape and colour to what people believed and understood. Observation is the basis of knowledge and practice, not experiments that are carried out under controlled conditions. Therefore one can interpret cosmo vision as rooted in a social context that sees the world in terms of social and spiritual relations between all life forms that sustain their

economic base. The participatory documentation of culture and indigenous knowledge is the first step towards understanding cosmo vision.

With this background, Green Foundation has attempted to promote biogenetic and cultural diversity as a basis for sustainable livelihoods and endogenous development. There are cultural barriers between the urban and the rural which make it difficult for the urban mind to accept indigenous knowledge. Therefore the attempt here has been to restore faith in the indigenous system by restoring the practices that are the basis of livelihood development in the dry land regions of the Deccan plateau in South India, which are on the verge of extinction.

Underdevelopment is generally perceived as the absence of consumptive power and lifestyle perched on western science and technology. But the reality is that poverty and underdevelopment are conditions merely created by the external and invisible costs of resource intensive and resource destructive processes. The approach to endogenous development is rightly based on the platform of biodiversity conservation and all the processes that enhance it. Green Foundation perceives seed conservation and exchange as sanctified. According to Green Foundation, crop varieties have a cultural significance and rural technology, which is inventive and original, is also ecologically sustainable. For an agrarian community the concept of endogenous development is thus embedded in sustainable ways of utilizing, maintaining and sustaining biodiversity.

‘Compas’, Green Foundation’s field program to link biodiversity with culture was started in 1997 in a highly complex environment, which was fast changing, and influenced by the market. The communities that Green Foundation works with are captives of the market phenomenon. The conflict between traditional values and modernity is very apparent in the hybrid rural culture of the region, fostering plurality and a diminishing sense of identity amongst the farmers. Ironically, there also rests a culture, which has not severed its links with nature.

Against this backdrop Green Foundation has adopted a two pronged approach - where agricultural societies still remain

relatively untouched by market forces, it creates awareness about the need to conserve traditional agricultural practices and biodiversity. However, where farmers have also imbibed modern ways, Green Foundation has found ways to empower them to make informed choices to revive indigenous crop diversity.



Seed diversity mapping has been undertaken and in situ conservation promoted in the region. In some of the interior villages where modern varieties have not been introduced vigorously, farmers have maintained the landraces in situ for generations. There is a subtle difference between in situ and on farm conservation since in many other villages which are nearer the urban areas where the rate of erosion is high on farm conservation is resorted to with collections from other similar eco regions.

This process of on farm conservation has augmented the plant genetic diversity in the area. Wherever villages are under the influence of the market, Green Foundation has made an attempt to encourage autonomy and choices by asking farmers to conserve landraces on a small portion of their land, and observe and evaluate. In the case of farmers who have been conserving these varieties for generations the choice has already been made and it is only a question of making them aware that they need to continue the conservation. In the process of increasing genetic diversity the idea of forming a seed village was born. Yerindyapanahalli, a village where a heterogenous community of subsistence farmers survive on agriculture was the first seed village. Here, 23 farmers are participating in a program to conserve 24 varieties of food crops, partly to address their food needs. (See page 69).

Traditional agriculture in India is one of the oldest yet one of the most advanced forms of food production. Traditional practices

are the result of a science that is accessible to people as they go about their daily work. Farmers choose crop types or varieties depending on soil depths, water holding capacity, slope and drainage and by observing and interacting with each other. The combination of different agro climatic conditions such as low rainfall, high temperatures coupled with different soil conditions have dictated various crop combinations and crop rotations. The limitation of family labour has further determined the type of crops and cropping patterns.

The village folk who live in close proximity to nature accept the all-pervasive influence of the forces of good and evil and glorify nature in various forms. 'Prithvi' (Mother Earth) is perceived as a powerful goddess who sustains plants. Trees, animals, mountains, lakes, stones and weeds are deified and worshipped with great reverence. The relationship between the spiritual, natural and social world put together as cosmo vision guides the philosophical and scientific premises behind the farmers' interventions in nature.

A glimpse into the life of 70 year old Chikkanna belonging to the Irula community of Masthapandoddi illustrates the indigenous knowledge of healing and cosmo vision. His daily life is governed by a series of rituals (largely spiritual), which shape his mental well being in general. Getting up from the right side of his bed, he looks at the picture of the family deity hanging on the wall. He believes that all will go well that day after this act of obeisance and prayer, which has a therapeutic effect on him emotionally and mentally. After washing his face, he stands and prays, facing the east. He believes that the sun is a powerful and divine force, which gives brightness and energy. He then offers prayers to his household deity.

He feeds the birds before he can partake of his food since he believes in giving back to nature what he takes from her. He collects medicinal plants only on auspicious days and prays before they are plucked. The medicines are made with reverence and he observes a fast. The medicines are not administered on Mondays and Saturdays. New moon days are chosen for administering medicines to chronic and old patients.

Rituals and worship of nature in Karnataka

The close links between culture and biodiversity can be aptly described as the panorama of rural livelihoods being drawn on the canvas of culture with the hues of biodiversity. Studies on the rural livelihood systems have indicated that besides the oft observed caste system, kinship and folk religion of rural India, there is a need to study the role and significance of culturally embedded practices of production, the articulation of rituals in changing forms, the shifting significance of cultural prescriptions and the development of new symbolic forms.¹¹

The cultural ethos of rural India goes back several thousand years. Life in rural India as in any other part of the world is embedded in the symbolic worship of nature and rituals very specific to each region. The heterogeneity of the communities in the Indian sub continent adds color and life.

In recent times cultures have been demolished in the pursuit of “development”. The government and other agencies have introduced a disjunction between cultural idioms and changing social structures. Though development interventions are meant to counter the growing levels of poverty and deprivation there have been unintended results that have alienated people from their roots.

Bearing this in mind Green Foundation is working under the umbrella of Compas for conserving biodiversity. Compas is a forum that works for intercultural dialogue to bring a synergy between the spiritual, social and natural worlds. It has drawn the links between biodiversity and culture. It has been recognised that in supporting indigenous agriculture, cultural revival is an important step towards reinvesting people’s faith in themselves. The documentation of agricultural rituals is an essential feature of the efforts in initiating the roots of endogenous development, as envisaged by the Compas program.

Agriculture as a livelihood encompasses a multiplicity of tasks combined with the judicious use of resources in the form of water, soil and the biodiversity. Various natural elements,

¹¹ Vasavi, AR: *Harbingers of Rain: Land and Life in Southern India*, OUP. (1999)

processes, flora and fauna are closely observed, understood and integrated into the cultural agenda. There is not a moment of monotony in the lives of agrarian communities, which are filled with the colour of rituals either to celebrate or probe the intricacies of nature. The indeterminate nature of the symbols used in these rituals leaves room for creative interpretation. If one understands the symbols it becomes explicit that people have not probed into the material nature of the world but into its inner meaning. According to their beliefs “meaning and the purport of existence cannot be researched in the outer but only in the inner reality.” While meaning and purport are as important foundations of livelihood systems as natural resources and food, they do not lend themselves to the same type of description. They can be visualized, felt and communicated only in symbolic terms.¹²

In India, as anywhere else, farmers believe that the gods or mythical heroes and heroines always influence human activity. “Whatever man undertakes on earth, whatever happens in this world derives its meaning and is inherently directed by the embrace of the sky and by the heavenly laws.”¹³ The essence of the matter is, “Human activities are not exclusively dependent on technical, economic or ecological considerations alone; they are embraced by an inner need, an intuitive knowledge, a psychic necessity too,” says Ruedi Hogger. It is obvious that culture is the binding factor in capturing the various rituals associated with agriculture and what emerges is the celebration of life, the diversity of life forms and the symbolic need to explore and expand the psychic dimension.

Taking all this into consideration an attempt has been made to describe the underlying cultural basis of biodiversity and agriculture which are the twin aspects of livelihoods systems without intending to seek a rationale in the intricacies. Agriculture in rural India has always been full of colorful events. Unlike modern agriculture, it is not just a source of livelihood, but part of the depth and breadth of the lives of the peasants. Despite the fast eroding bond with the ways of farming, there do exist vestiges of the link that farmers maintain with the seasons

12 Hogger, Ruedi: *Understanding Livelihood Systems as Complex Wholes*. (mimeo) RLS
An Indo Swiss Research collaboration. (2000)

13 Kramrisch, Stella: *Exploring India's Sacred Art*. New Delhi. (1994)

and the calendar. This no doubt forms the basis of knowledge, practices and the very attitude towards the life sustaining processes in agriculture.

It is natural, therefore, for rituals to have their place in the cultural life of rural people. These rituals have their specific function of maintaining the cosmic balance. Starting with the new plough known as 'honneru' that signifies the worship of the earth, up to celebrating the arrival of the rains called 'malerayana habba' and worshipping the sun and moon during the harvest festival called 'Makara sankranthi' when the constellations change their path, all these rituals have their roots in the worship of the five elements of which life is comprised.

Agricultural rituals have been a significant way of seeking a rationale that coincides with the different field operations in a full cycle from land preparation to harvesting and testing for germination. In Karnataka, the cultivation season begins with the new year when the stored grains are brought out to celebrate the ritual called 'Negilu Pooje' followed by similar significant rituals that mark the major milestones in the year-long agricultural seasons. Farmers and communities have evolved a unique way of relating to agriculture - an essential feature of their livelihood. The rituals not only signify the celebration of life, they also bring the community together.



1. Invoking the rain god
'Mallerayana habba'
2. 'Honneru' - The first plough

Agricultural rituals

The 'Negilu Pooje' is perhaps one of the oldest and most symbolic of agricultural rituals, performed by farming communities on new year's day according to the Hindu calendar. Two new wooden ploughs are placed in the north-eastern corner which is considered sacred. An areca palm leaf folded into a deep bowl is tied to the plough. The palm leaf is filled with manure in which seeds are sown. The seeds representing the diverse crops like finger millet, niger, field bean, horse gram, red gram, mustard, paddy and castor are left to germinate for a period of nine days. This is a symbolic way of testing for germination of the seeds. Good germination ensures a good crop for the coming year. After nine days the worshipped bowl is transferred to a nearby water source for immersion, thereby bringing together the natural resources such as water, soil and seed.

Farmers wait for the first rain to perform the ritual 'Honneru' which will portend a good year of agricultural activities yielding a good harvest. With the advent of the first rains in the Kharif season, the plough and land are worshipped in a colorful ritual where vermilion and turmeric are applied to the plough which is referred to as the "Golden" plough. On this occasion the village elders come together and give the green signal for ploughing to start. Sacred offerings of 'til', jaggery and rice are made to Mother Earth and then to the women who signify the earth. Seed diversity or "Navadanya" is tied to the seed drill and the horns of the cattle.

Farmers integrate philanthropy and a sense of self provisioning in their farming systems. Illustrative of this is the 'koorige' or the seed drill, which has three compartments through which the seeds are dispersed on the land. Rakeenamma articulates the philosophy when she says, "Ondu manisharige, ondu akkekalu thinnage mathodondu dharmake"- one portion of what they grow is for themselves while the other two provide food for the birds and for charity.

The next in the line of festivals is the 'Karibanta' performed during the months of September and early October to protect the crops from pests. The 'Ubbe' and 'Uttare' rain bring the earheads

to maturity. During this period the crops are most vulnerable to pest attack. The branch of the tree locally known as Pachadi (*Dalbargia peniculata*) is fixed in the field and acts as a protection against pests while it turns black overnight. This is performed not by individual farmers but the community as a whole. An animal sacrifice brings the ritual to a high point when the blood is also sprinkled over crops.

Farmers look forward to the harvest with joy and trepidation. A post harvest festival, the 'Rashi Pooje', also referred to as 'Kalada Devaru' or 'Bhoodana Kavala' is performed between the months of January to March as thanksgiving for a successful harvest. The threshing yard is cleaned and swabbed with cowdung, perhaps to ensure purity of the harvested seeds. After the threshing, the crop yield is piled up and the idol of 'Pille Raya' is placed on top of the heap facing the North-East and worshipped. The heaps are also decorated with agricultural implements like winnow, broom, sickle and sieve, and with weeds and flowers. The grain is then taken home.



Celebrating the harvest - 'Sankranthi'

A cowherd was grazing his cattle in the forest. A cow, named “Punyakoti” had a new-born calf who had been left behind at home. While grazing, Punyakoti fell prey to a hungry tiger. She promised the tiger that she would bid farewell to her near and dear ones and return that evening to be his meal. Punyakoti returned to her village and told her child and family what had happened. They were all very sad because the calf would become an orphan (tabli). Requesting her family and friends to take care of her calf, Punyakoti returned to the forest as promised and requested the tiger to devour her. Taken aback by the trustworthiness of the cow, and filled with remorse, the tiger fell dead.

Villagers believe that on Sankranthi day, the cow was rescued from death and from the clutches of the tiger. Jumping the fire symbolizes overcoming difficulties. This is also believed to cure the cattle of foot and mouth disease.

Source....A villager in Lingapatna village



Rain plays a very significant role in the lives of farmers who are dependant on it for cultivation. The Indian farmer has long relied on local wisdom to predict the onset of rains. Farmers see rainfall as a phenomenon which occurs once in fifteen days. Every rain is said to have four 'padas' with each 'pada' lasting for approximately 3.5 days. Rainfall is also linked to the stars which in turn govern all agricultural operations. Farmers understand this phenomenon so well that they can actually describe the impact of rain on their food production. "Bharani male biddare dharaniyakka davasa" which means, "If the Bharani rains are good the earth will provide plenty of food."

A farmer's ability to predict the rains, based on natural indicators is comparable to the modern scientific methods used for the same purpose. The cultural association with rain can be seen in the different festivals celebrated to welcome it and offer thanks. When the rains fail, farmers believe that they have failed to fulfill their dharma.

The everyday life of rural people, which is dependent on nature's vagaries, is full of such events and rituals. These become part of their culture. No explanations can be offered to relate this to rational thought, but it has become a significant part of their lives.



'Malleraya' is invoked by the people to bring rain and avert drought

Conclusion

Diversity in agriculture is the heart of sustainability. Seeds symbolize the very life of agriculture. Since intra and inter species diversity in crops is managed by the farmers particularly in the rain fed regions, they become the ecological niche for the varieties. The diversity in cropping patterns is an essential part of the culture, beliefs and practices of the farming community. Any intervention to restore lost genetic resources necessarily has to be based on the participation of the local community.

A decade of nurturing by Green Foundation has resulted in the widening of the gene pool of the area. On farm conservation of threatened species and varieties needs not only technical skills but also the sensitivity to draw farmers into the process and revive their accumulated skills and experiences. The genetic resources have been considered valuable not only as breeding material but also as a source of food security. The intervention has included improvement of the potential of the landraces, development of markets for farmers' produce, establishment of community based seed banks, networking and integration of conservation strategies at all levels in order to sustain the system of local seed supply.

The community seed bank, as described by Dr Regassa Flyissa of Ethiopia is not just a store where seed is kept for distribution or marketing, or a sophisticated storage facility which has temperature and humidity control. It is a system in the process of community agriculture which includes village level facilities, a garden or field where traditional varieties are safeguarded. Through this system, farmers have played a key role in the creation, maintenance and promotion of crop genetic diversity. With the help of traditional skills which they have developed over centuries, they have been selecting crop varieties to meet their specific needs such as quality, resistance to pests and pathogens, adaptation to soils, water regimes and climate etc. Under this system local farmers have established their own seed networks to facilitate seed supply to their families and local markets. Community seed bank therefore is a system composed of all of the above. It is among the major strategies for maintaining genetic diversity in crop/plant species.

The community seed bank has two major components: a seed store and germplasm repository for local crop improvement complementary to the field gene bank. The annual grow out from the germplasm repository in the field serves to maintain the viability of the seeds. The seed store represents a seed reserve consisting of landrace material grown locally. The store becomes a back up to the local market networks where farmers normally exchange seeds and information. The seed reserve that the community seed banks maintain becomes crucial to ensuring a sustained supply of adapted seeds, channeled through informal market systems. This averts the potential loss of genetic diversity. The seed storage units are traditionally used items such as clay pots, underground pits and seeds bundled into straw baskets. There is scope for improving these structures depending upon the local skills.

The adopted approach has enabled farmers to control the choice of crop types adapted to local conditions. Critically evaluating the relative merits of a wide range of cultivars allows farmers to have confidence in their chosen variety. This makes them self sufficient and removes their dependence on the market. Marketing of both seeds and the grains are seen to have great potential in taking the concept further. The alternative seed system also needs to be supported by an alternative marketing system for both seeds and grains. A farmer/consumer linkage eliminating the middlemen is necessary and ideal to bring the benefits to both the farmer and the consumer. Several experiments across the world have illustrated the fact that consumers will support farmers' varieties, taking into account their own health while awarding a remunerative price to the farmer/producer.

This is possible if the alternative marketing can be organized locally. Organized markets also have different levels of functioning and the benefits accrue invariably to the higher levels leaving the farmer/producer with very marginal advantages. If one has to take the initiative to a logical end, it has to be integrated at one end with sustainable soil and water management for better yields and marketing infrastructure for better economic returns. Between the two ends there is a whole range of activities that need to be integrated for a wholistic approach to conservation.

Glossary

A

Agricultural calendar

Agricultural activities linked to the new moon and full moon, and the rainfall linked to the 27 different stars

Agricultural rituals

Rituals linked to different agricultural processes

B

Biodiversity

The quantity of different types of organisms

Biodiversity register

Record of the diversity in flora and fauna

Bio-resources

Living natural resources, including plants, animals and microorganisms, plus the environmental resources to which species contribute. Biological resources are the practical target of activities aimed at the principle of conserving biological diversity; they have two important properties, the combination of which distinguishes them from non-living resources: they are renewable if conserved, and they are destructible if not conserved

C

CBD

Convention of Biological Diversity adopted in Nairobi on 22 May 1992. The convention is a legally binding agreement for conservation and sustainable use of biodiversity. It came into force on 29 December 1993

CGIAR

Consultative Group of International Agricultural Research

Characterization

The measurement of all characters with high inheritance and which express in all environments

Community intellectual rights

Rights of the community to protect the knowledge generated and owned by the community

Community seed bank

Organized informal seed storage by the community, for the community

Conservation

The management of human use of the bio sphere so that it may yield the greatest sustainable benefit to the present and future generations

Cosmo vision

The way a certain population perceives the world or cosmos

D

Dry land tracts

Rainfed agricultural land

E

Ecology

A branch of science concerned with the inter-relationships of living organisms with each other and their environment

Ecosystem

The totality of factors of all kinds that make up a particular environment; the complex of biotic community and its abiotic, physical environment, functioning as an ecological unit in nature

Endogenous development

Development initiated by people as perceived by them

Ex situ conservation

Literally, conservation 'off site' or outside an organism's natural habitat

G

Gene bank

A form of ex situ conservation for plant, seed and animal germplasm. Gene banks are usually humidity and temperature controlled facilities where seeds and other reproductive materials are stored for future use in research and breeding programs. Gene banks that stock germplasm from crops are called seed banks

Gene pool

The total of the alleles in a population of organisms

Genetic resource

A genetic resource is the heritable characteristics of a plant or animal of real or potential benefit to people. The term includes modern cultivars and breeds; traditional cultivars and breeds; special genetic stocks (breeding lines, mutants, etc.); wild relatives of domesticated species; and genetic variants of wild resource species

Germplasm

The total genetic variability, represented by germ cells or seeds, available to a particular population of organisms

Globalisation

The creation of seamless, borderless global order with increasing de-nationalization of the nation state and its sovereignty

GMO

Genetically modified organisms

Green Revolution

A massive and controversial agricultural research and production strategy which aimed to increase the output of staple grains in the South starting in the 1960s. Initially funded by the Rockefeller Foundation, it was later supported by aid from Northern Governments. The Green Revolution was based on the belief that world hunger was basically a technical problem which could be fixed by raising agricultural production through high yielding varieties of a few staple crops

H

Herbicide

A type of pesticide that destroys foliar or plant pests such as weeds

High yielding varieties

Varieties bred especially to express the yield potential by responding to external input

Hindu calendar

Calendar of events based on the position of the moon and the sun

I

Indigenous knowledge

Knowledge originating in a particular region

Indigenous varieties

A grouping of plants within a species which share a common character and are indigenous to the area

In situ on farm conservation

Literally, conservation on site. This involves conservation of habitats and ecosystems

Intellectual property rights

IPR is a protection given to the inventor or developer that secures for him/her over a specific period of time exclusive rights to produce, use and sell an invention, process or a new breed of plant

L

Landraces

A cultivated variety developed by the farmer, usually a complex, heterogeneous genetic population

M

Marginal environment

Environment with poor conditions of soil and rainfall

Mega biodiversity countries

Countries endowed with rich natural diversity

Monocultures

Uniformity in plant cultivation

Mulching

Plant debris or sand used as a protective covering of the soil surface

N

Nehruvian model of development

Industrially oriented development

P

Panchayat

Form of local administration by people

Pesticide

Chemicals used to kill pests

Phenotype

The external appearance of a plant

Plant genetic resources

Plants with heritable genetic resources

S

Seed keepers

People who conserve traditional seed varieties

Sui generis

Literally, 'of its own kind' that is, in a class alone. This refers to any unique form of intellectual property legislation specifically designed to meet certain ends

Sustainable development

A pattern of social and structural economic transformations that optimizes the economic and other societal benefits available in the present without jeopardizing the likely potential for similar benefit from the relationship

T

Tillering

New shoots of plants

TRIPS

Trade Related Intellectual Property Rights

W

Weedicide

The chemical which kills the weed

WTO

World Trade Organization

APPENDIX - 2: GENETIC RESOURCE CONSERVATION

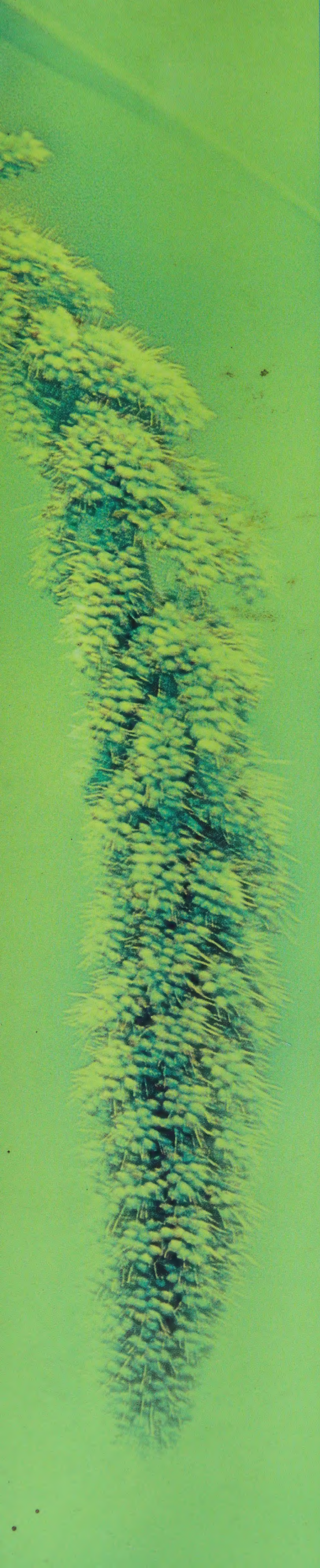
AGALAKOTE - ● 3 ■ 9 ▲ 3	CHIKKAMALLALLI - ● 27, 25 ▲ 11, 14, 2, 21 ■ 14, 15, 2, 13, 6, 11	GUMMALAPURAM - ♦ 2, ■ 2, 7
AJJABASAVANA HALLI - ♦ 7	DASATANA DODDI - ● 3, 4, 22, 7, 10 ■ 1, 11, 4, 7, 18, 16 ▲ 3, 4, 14, 8, 5 ■ 1, 7, 3, 12, 8, 10, 11, 5	GUTTHALAHUNISE DODDI ■ 20 ♦ 16
ALAGAPAKALU - ● 14, 10, 15, 9 ■ 6 ♦ 4, 12 ▲ 5, 10, 3, 1, 17	DODDAGULI - ♦ 1	HALASUR - ● 2
ANCHETTY - ● 30, 29 ♦ 13 ■ 11, 22, 13, 2 ▲ 16, 14, 2, 6, 10, 4	DODDAKABBALI - ♦ 2	HANUMANTHAPURA - ■
ARTHAKAL - ● 2, 13 ■ 3 ▲ 8, 16, 2, 5, 3, 4, 13, 11, 9, 6, 12, 23, 24 ■ 13, 5, 7	DODDAMALLALLI - ● 29, 21, 27, 25, 4 ■ 22, 13 ▲ 11, 14, 2, 10, 21 ■ 15, 14, 13, 11, 6	HAROHALLI - ▲ 1, 16, 10
ATHINATHA - ● 27 ■ 6 ■ 13, 12 ▲ 7, 2, 13, 6, 14	DYAVEGOWDANA DODDI - ■ 26 ▲ 7, 11, 14	HOSADURGA - ● 2, 15, 4, 9, 10 ■ 1, 4, 3 ▲ 7, 5, 9, 10
ATTALAVADI - ▲ 23, 24, 6, 7, 22 ● 21, 24, 11, 13	EKKULI - ● 31 ■ 1, 6 ♦ 2	HOSAHALLI - ♦ 2
BEEMSANU - ● 2, 17 ■ 16 ♦ 2, 16	ELACHAVADI - ▲ 2, 5, 13, 25, 1, 16, 10, 3, 7, 24	HULIBANDE - ● 25, 26 ■ 10
BENACHAKAL DODDI - ▲ 13, 5, 2, 3, 7, 25, 1, 16, 10, 24	GANIGE DODDI - ▲ 24, 7, 3, 10, 16, 1, 29, 2, 6	HULUGONDANAHALLI - ■
BETTA - ♦ 7, 19 ● 23 ■ 9 ▲ 2, 5, 13, 25, 1, 16, 10, 3, 7, 24	GARALAPURA - ♦ 2	INDIRANAGAR - ▲ 11, 8, 10
BILIKAL - ● 2	GATTIGUNDA - ♦ 13 ▲ 4	JAWALGIRI - ♦ 8
BUNDUGAYYANA HALLI - ▲ 2, 5, 13, 25, 1, 16, 10, 3, 7, 24	GEJANAGUPPA - ● 17 ■ 4 ♦ 7	JEENMALLATHA - ● 29 ▲ 11, 2, 7, 16, 9, 14
CHAMUNDIPURA - ● 1, 2, 13 ▲ 3, 5, 16	GOLLAPALLI - ● 2, 17, 9 ■ 10, 16, 6, 9, 7	K. DODDI - ● 30, 29 ♦ 13, 2 ▲ 16, 14, 2, 6, 10, 11
CHANNAMALA - ▲ 15, 5, 4, 2, 16, 10, 6, 3 ♦ 13, 14 ■ 8, 9, 6, 4, 10, 11, 12, 13 ● 2, 6, 17, 8, 11, 9, 10	GOPASANDRA - ♦ 7 ■ 2 ■ 12, 9, 15, 16 ● 7, 2, 16, 13, 17	K.G. HALLI - ● 10, 7, 9, 1 ♦ 12, 16 ■ 6 ▲ 2, 13, 14
	GULAGANAHALLI - ● 1, 2 ■ 1, 3, 14, 27 ♦ 1, 7, 8, 2	KANAKAPURA - ♦ 1 ▲ 16, 10, 3, 7 ● 2

FINGER MILLET ●	17. UGANDA RAGI 3624	35. HAGALAKOTE RAGI	11. MARUDI	28. MARAN
1. GIDDA RAGI	18. MURUTHINGALA RAGI	36. MITTA RAGI	12. KARI NELLU	29. BILI MU
2. MAJJIGE RAGI	19. HASIRUKAMBI RAGI	37. BONDA RAGI	13. KALOGAYA	
3. JENUMUTHIGE RAGI	20. SANNAKADDI RAGI	38. CHANDU HOO RAGI	14. BILI BUNDUGA	WETLAND
4. PICHAKADDI RAGI	21. BILI MUNDUGA RAGI	39. THUNDU HARISHINA RAGI	BATHA	1. SALEM S
5. MADAYYANA GIRI RAGI	22. JENU BUNDUGA RAGI	DRYLAND PADDY ■	15. KARI MURUDUGANA	2. RASKAC
6. KURUBA RAGI	23. KADDI RAGI		16. DODDI BATHA	3. BASUMA
7. UGANDA RAGI 3621	24. GUTTA KINDALA RAGI		17. KAR	4. GODHAY
8. MANAVARI RAGI	25. BILI GIDDA RAGI	1. ANEKOMBINA BATHA	18. NURUGAN	5. RATHNA
9. DODDA RAGI	26. BAYALU SEEME RAGI	2. NEERUMULUGUVA BATHA	19. MADU MULANGI	6. GEERAG
10. KOLIMOTTE RAGI	27. KARIGIDDA RAGI	3. ONDUVARE BATHA	20. KEMPU MUNDUGA	7. KICHADI
11. VL 149 RAGI	28. KARIMUSUVANNA RAGI	4. DODDA BHAIRANELLU	21. MUGANDA BATHA	8. PONGA
12. HASIRU BUNDUGA RAGI	29. DODDA RAGI - URIGAM	5. BILI MUNDUGA	22. MUNDUGA	9. HALAGA
13. ORISSA MANDYA	30. JENUMUDDE RAGI	6. BILI NELLU	23. PICHANA KAR	10. SANNA
14. KEMPU RAGI	31. HULLUPORE RAGI	7. SANN MUNDUGA	24. VIDA KUMUDANCHAN	11. KULLA
15. BILI RAGI - VGKK	32. BONDA RAGI	8. KARI MUNDUGA	25. DODDA PANDE	12. KANRA
16. KONA KOMBINA RAGI	33. JENUGUDU RAGI	9. MOTTAIKAR	26. VELLAIKAR	13. MEENA
	34. ARUNA RAGI	10. SALU BATHA	27. 3 MONTHS PADDY	

MAP OF SUBSISTENCE CROP (2001-2002) - KEY TO MAP

16 ▲ 2, 10, 7 D - ● 22, 13, 10 6 ▲ 11, 14, 9, 3 0, 3, 7, 2, 5 7, 6, 4, 1, 8, 2, 16 ■ 3 13, 14, 11, 8 ◆ 21, 7, 5 14, 2, 9, 10 ■ 6 ◆ 13 13 ■ 11, 22, 4 2 ■ 6, 12, 5 16, 15 13, 5, 2, 25, 1,	KARADI DODDI - ■ 9 ▲ 2, 5, 13, 25, 1, 16, 10, 3, 7, 24 KOMARTHANA HALLI - ▲ 3, 11 ◆ 4, 7, 20 KOMELOWDANA DODDI - ● 2, 5 ■ 2 ■ 3, 4 KONANAKUNTE - ● 29, 4 ■ 4 ◆ 13 ■ 13 KOTTAIYUR - ▲ 10, 11, 5, 8, 4, 2, 7, 13 ■ 15, 6, 2 ■ 22 KUMBARA DODDI - ▲ 2, 5, 13, 25, 1, 16, 10, 3, 7, 24 KUNIGAL - ● 20, 4 ■ 9 ◆ 7, 3 ▲ 2, 7, 1, 8 ■ 7, 6 MADAKAL - ● 4 MADIGARA DODDI - ▲ 24, 7, 3, 10, 16, 1, 25, 13, 5, 2 MALLAPPAJI DODDI - ● 7, 22 ■ 9, 20, 16 ▲ 2, 5, 13, 25, 1, 16, 10, 3, 7, 24 MANCHIBETTA - ● 27, 18, 6 ■ 4, 6 ■ 6, 7, 11, 13, 14, 15 ▲ 8, 14, 18 MANDLA HALLI - ▲ 2, 5, 13, 25, 1, 16, 10, 3, 7, 24 MARALAWADI - ◆ 1 MARUPALLI - ▲ 2, 3, 4 MANUHIGERE - ● 16 ■ 13 ▲ 4, 5	NANDIMANGALA - ● 7, 11 ■ 12 ■ 14 ▲ 5, 3, 4 NAYAKANAKOTE - ● 32, 29, 3, 4, 27, 2 ■ 11 ◆ 7 ▲ 14, 2, 9, 17, 4, 7, 11 P. DODDI - ● 2, 4 ■ 2 ◆ 1 ■ 2, 1 RAMPURA DODDI - ◆ 6 S. DODDI - ● 26, 25, 29 ■ 9, 11 ◆ 18 ▲ 16, 8, 14, 4, 17, 6, 10 SHAMANATHA - ● 17 ■ 15, 16 ◆ 2 THAGATTI - ● 4, 2, 27, 29, 22 ■ 1, 7, 4, 11, 21, 27, 13, 10 ◆ 17, 15, 5 ▲ 11, 1, 7, 2, 6, 3, 4, 9 THERUBEEDI - ● 7, 22, 24, 14, 2, 23, 36 ■ 13, 10, 19, 20, 16, 6, 11, 13, 14, 18 ◆ 19, 18, 7 ▲ 2, 5, 13, 25, 1, 16, 10, 3, 7, 24 ■ 5, 7, 8, 10, 6, 16 UKKADA - ● 2 ■ 6, 8 ▲ 2, 5, 13, 25, 1, 16, 10, 3, 7 URIGAM - ● 29, 4, 2, 3, 33, 15 ■ 9, 4, 16, 11, 6, 27 ◆ 16, 19, 1, 6, 7 YERIDYAPANAHALLI - ● 2, 1, 3, 4, 31 ◆ 2, 3, 1, 4, 5, 6, 15, 18, 7 ■ 1, 2, 3, 5, 6, 12 ■ 1, 3, 6, 20, 27 ▲ 1, 2, 19, 6, 7, 10, 14, 13, 8, 5, 4, 21, 22, 16, 15, 11, 9, 23, 24
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WELLU RUGANA BATHA PADDY ◆ SANNA AM ATHI ARI CHUDI IA SAMBA SAMBA PONNI ATHIKARI KAR THNACHUDI MPU	14. HONNE KATTU 15. RAJMUDI 16. RAJKAMAL 17. THOOTAMALLI 18. GANDHA SALE 19. 60 DAYS PADDY 20. KANNURUBATHA 21. SAMBALAI 22. LAXMI KAJAL 23. THRIN GODAL 24. NEELAM SAMBA 25. MUNGESARI VEGETABLES ▲ 1. WINGED BEANS 2. LADIES FINGER 3. CREEPER BEANS	4. TOMATO 5. CARROT 6. RADISH 7. BOTTLE GOURD 8. EGG PLANT 9. SWORD BEANS 10. DOUBLE BEANS 11. RIDGED GOURD 12. SNAKE GOURD 13. RAMDHAN 14. PUMPKIN 15. PENDAL BEANS 16. SPONGE GOURD 17. DHILLY 18. URIBEEJA (RAMDHAN GREEN) 19. 3 MONTHS BEANS 20. TREE POTATO	21. ONION 22. GORI KAYI (CLUSTER BEANS) 23. PASSION FRUIT 24. CUCUMBER 25. GREENS OTHERS ■ (PEARL MILLET FOXTAIL MILLET, LITTLE MILLET, GROUNDNUT) 1. GROUNDNUT CREEPER 2. PEARL MILLET (IE) 3. DODDA SAJJE (PM) 4. MULLU SAJJE (PM) 5. RICE BEAN	6. HULLU SAME (LM) 7. RED GRAM 8. BARNYARD MILLET 9. KARINAVANE (FM) 10. KORALU (PROSO MIL) 11. CASTOR 12. SUNFLOWER 13. JOTHAGU NAVANE (FM) 14. KUYILU NAVANE (FM) 15. DODDA SAME (LM) 16. SORGHUM
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HIDDEN HARVESTS

Community Based Biodiversity Conservation

This publication captures a decade of Green Foundation's work on conservation of biodiversity and its multiple functions

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